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Industrial Editor: J. H. COSENS *Technical Consultant:* C. O. BRETTELLE, M.I.E.E.

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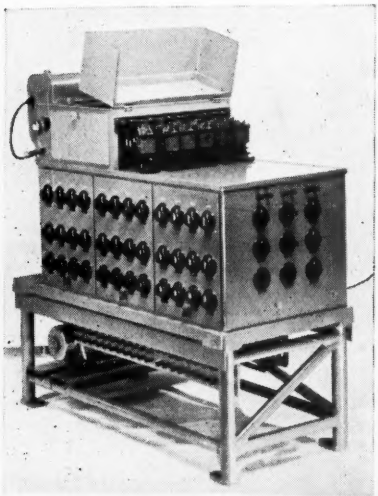

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ELECTRICAL REVIEW 20th FEBRUARY, 1953

THE OLDEST ELECTRICAL PAPER • ESTABLISHED 1872 • VOL. CLII • NO. 8

Turbine Rotors

HIGH steam pressures and associated high temperatures have created many problems relating to the design and operation of turbo-alternators which only experience gained under actual running conditions is likely to solve. Principal difficulties in design, as such, appear to have been surmounted and a stage of development has been reached at which distortion of the high-pressure cylinder, misalignment and stresses due to temperature differences in the casing are secondary to transient bending of the rotor caused by non-uniform transverse temperature distribution in it, though the latter is affected by similar heating and cooling in the cylinder.

This view, which was advanced by Messrs. J. S. Hall and O. Howarth in their lecture to the E.P.E.A. (London Technical Group), reported in this issue, is backed by evidence from initial operation of some of the larger standard turbo-alternators now going into commission. Having regard to the preliminary dynamic balancing and stress relieving treatment of rotors at the manufacturers' works, thermal instability seems to be ruled out as a cause of reported vibration troubles in a few instances, as indicative of rotor eccentricity. These troubles can almost always be traced to insufficiently developed technique in starting and shutting down sets—that is in raising and lowering the temperature of various parts to those requisite for operating conditions, after which they should run smoothly for almost indefinite periods.

Discussing the bearing of the first critical speed, the authors suggest that, with further knowledge of transient bending phenomena, all large impulse turbines may have lighter flexible rotors running above the critical value, with the further advantage of lower thermodynamic losses due to gland leakage. More precise information is still needed as to the safe rates of rise of temperature and no doubt manufacturing improvements will enable the limits to be extended, but the question will remain essentially one for operating staffs to

answer, especially with the two-shift working to which the plant will ultimately be relegated. Although speaking primarily as designers, the authors are able to give some valuable advice, based on tests well chosen to illustrate the main principles. They of course put forward no panacea, if only for the reason that the numerous factors involved vary from machine to machine, but they point out the necessity for caution until the rate of heating each individual set will accept comfortably has been established. There is no substitute for that experience.

BOARD'S DONATION

The Midlands Electricity Board has been reproached because last year it contributed £5,000 to the Birmingham University Developments Appeal Fund. Alderman W. Lewis, the chairman of the Board, has defended its action on two grounds: first that this was an obligation inherited from the former Birmingham Electric Supply Department and secondly that a contribution to the University was considered a good investment because University research benefited the electricity supply industry and because the University provided suitably qualified men for the Board's service. We agree with Alderman Lewis, for such expenditure is in the electricity consumer's ultimate interest.

DOMESTIC APPLIANCES

The fall in the production of domestic electrical equipment during 1952 was attributable to a combination of causes the incidence of which varied according to the particular class of appliance. It is obvious that there has been a decrease in public expenditure, accentuated by the Government's hire-purchase restrictions. On some appliances, such as refrigerators, water heaters and vacuum cleaners, there has been a continuance of punitive purchase tax. Above all there has been the solid-fuel appliance campaign with its suggestion that the use of electricity is wasteful of the nation's coal resources. In the interests of the public as much as of themselves the various branches of the electrical industry must do everything possible to combat these influences, which are largely exercised by interested parties.

HEAT PUMPS

The lower the temperature of flow water from a heat pump, the better is the coefficient of performance, or "reciprocal thermal efficiency" as it is termed by Mr. J. A. Sumner in the January issue of the *Journal of the Institute of Fuel*. On the other hand, Mr. H. L. Dawson points out in the same issue, to use low-grade heat over the full heating range requires a greater heat emission surface than would be needed if an electrode boiler were employed to boost the flow-water temperature when the external temperature fell below the mean winter value. By this arrangement the heat pump could be run continuously at nearly full load, thus minimizing the effect of its high capital cost.

AUSTRALIAN RELAXATIONS

When the Australian Government imposed its import restrictions last year the aim was to restore equilibrium in the country's dealings with the outside world. The measures taken have had beneficial results to Australia as a nation and, as a secondary result, to numerous Australian manufacturers. British exporters were promised that when the balance had again been restored there would be an easing of the restrictions. The announcement that the Australian Government has decided to relax its controls to admit an additional £A50 million worth of imports from the sterling area is welcome news, particularly to the British electrical industry which has been severely hit. At the same time the statement makes it clear that the protective aspect of the restrictions is being kept in mind and the relaxations are to be controlled in the interests of the employment situation.

Office Heating

Thermal Storage System at the New Bristol Council House

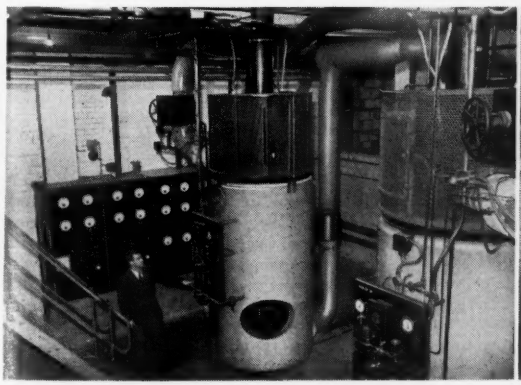
THE completely off-peak nature of the demand enables electric thermal storage systems to accord fully with the recommendations of the Ridley Committee regarding efficient utilization of the nation's fuel resources and also—a feature of more immediate and practical interest to the user—permits the suppliers of electricity to offer especially low rates for the purpose.

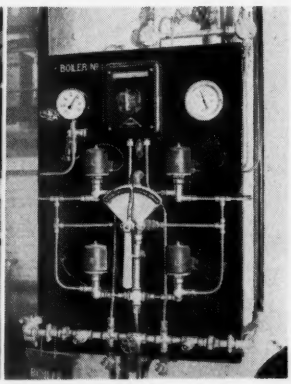
At Bristol, where the South Western Electricity Board's special rate for water heating between 10.0 p.m. and 7.0 a.m. ranges from 0·5d to 0·375d per kWh (with a coal clause), the City Council is a firm believer in the system. Following the successful and economic operation of installations at three public baths and the Bristol Central Clinic a comprehensive thermal storage scheme covering both space heating and domestic hot water supplies has been provided at the new Council House now nearing completion at College Green.

This building includes a large Conference Chamber, Council Chamber, Lord Mayor's and Lady Mayoress's Parlours, City Treasurer's Office, etc., and will in its 3,900,000 cu ft (approximately 200 rooms, including the Council Chamber), eventually accommodate practically all the Corporation's officials. For the heating system two 1,500 kW 6·6 kV Sulzer electrode boilers have been provided together with six 10ft 6in diameter by 18ft long thermal storage cylinders with a total capacity of 54,000 gal. One of these boilers is sufficient to meet all normal heating demands, the other unit being kept as a stand-by.

Operation of the plant is fully automatic, the sequence of operations being as follows. By operating the selected hand switch, providing the time switch and control

Above: **Bristol Council House, College Green.** *Below left:* **Electrode boilers with main control panels.** *Below right:* **Local control panel attached to one of the electrode boilers**





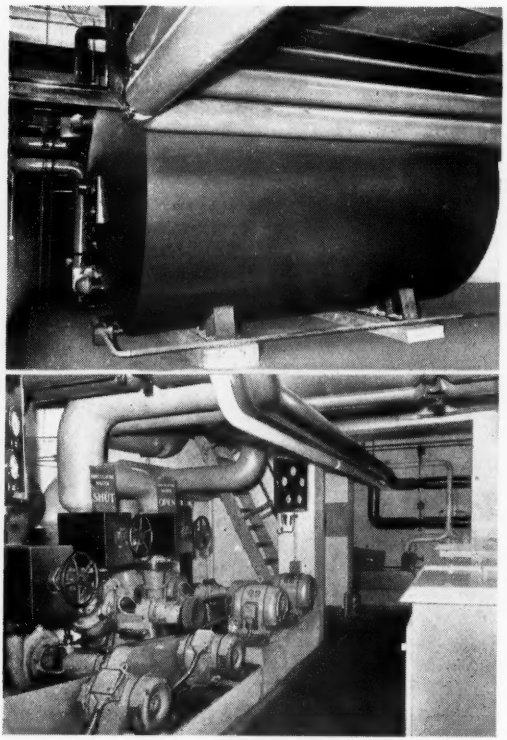
thermostats in the storage vessels are closed, the circuit is made and the control relay energized. This in turn closes a contact in the safety circuit, and with all safety devices intact, makes the circuit and actuates the primary pump relay. This operates a Watford star-delta starter, which brings into operation one of the two main Sulzer pumps (driven by Brook 15 h.p. 1,445 r.p.m. 415 V motors) which circulate the water from the six storage vessels through the boiler for heat transfer. As this pump motor changes over from star to delta running the oil circuit breaker governing the 6·6 kV supply to the electrode boiler is switched in, control thereafter being dependent on the "Satchwell" thermostats fitted in the base of the storage vessels and normally set to operate at 258 deg F. In addition there is a flow control thermostat on the boiler, and should for any reason both these units fail to operate there is a further emergency thermostat on the boiler set to operate at 270 deg F. Once this thermostat has operated it is necessary to reset the system by hand.

In order to make it possible to limit the demand each boiler is provided with an automatic load controller which gives any desired proportion of the full load by raising or lowering hydraulically quartz shields surrounding the electrodes. Limit switches are provided at top and bottom positions and the boiler cannot be switched on until the bottom limit switch is in circuit; this prevents the switching on of the boiler at more than minimum load. If desired the automatic load control can be switched out and manual operation employed, utilizing a hydraulic valve system.

Emergency "stop" switches are provided on both boiler and oil circuit breaker controls, other safety precautions including a flow-operated switch, an over pressure relay, a safety valve, and a safety switch on the cage round the electrodes on the boiler, with out-of-balance (10 per cent), overload (10 per cent), and no-volt relays on the oil circuit breaker. "Tangent" alarm bells give warning of any untoward event, and on the main control panel there are visual indications of excess load, primary pump overload, out-of-balance, water flow failure and excess temperature. Duplicate meters (Landis and Gyr) keep a check on the consumption of the electrode boilers.

Operation of pumps and fans (for the plenum installation provided for some parts of the building) is shown by pilot lamps on a separate panel where are also fitted a Negretti and Zambra temperature recorder and a 32 point distant thermometer. Mercury-in-steel thermometers (Coley) are fitted at top and bottom of the storage vessels, together with

The six thermal storage cylinders have a total capacity of 54,000 gal



Main circulating pumps with Watford control panels on the right

A portion of one of the plenum plants

Negretti and Zambra thermocouples.

The hot water in the storage vessels is circulated round heating panels throughout the building by means of Sulzer pumps (5 h.p. City Electric Co. motors). A Watford "Pigral" unit, which takes into account the temperature outside the building, automatically regulates the flow temperature sequence throughout the week including the special week-end arrangements. An overriding manual control can be readily brought into use for abnormal periods such as Bank Holidays.

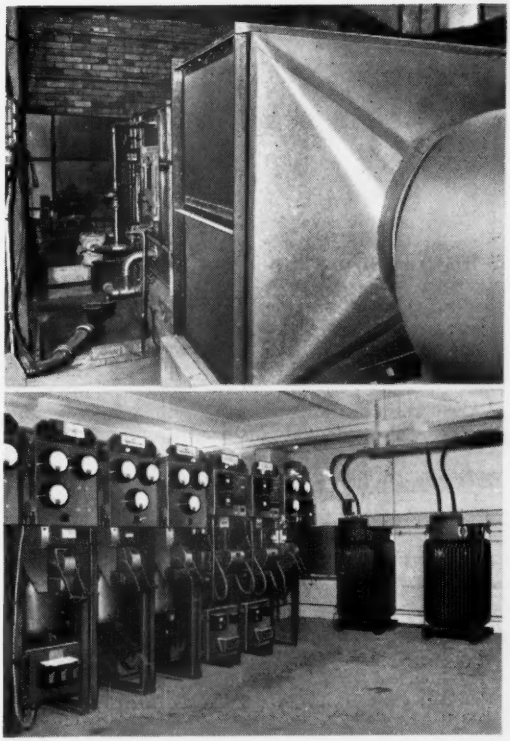
A separate circulating system served by duplicate pumps (with 3 h.p. Bull motors) is provided for the plenum installation. This comprises separate plants (Matthews and Yates) for three sections of the building.

Air is drawn into the building at ground level by intake fans and passed through washing plants and two banks of hot water radiators which it leaves at a temperature of about 150 deg F. Ducts carry the warmed air at a low temperature of about 140 deg F to inlets in the ceilings of the rooms served for eventual exhaust through outlets in the window sills by means of exhaust fans, provision being made for recirculation as required. Bull motors (mainly of 1½ h.p.) are employed throughout the plenum installation, with Brookhirst control gear.

For the domestic hot water supply there is a 4,500 gal cylinder fitted with 450 kW Bastian & Allen immersion heaters arranged in three banks of 150 kW each controlled by Process Control Gear "Proscon" thermostats. Overload protection is provided and it is possible to arrange for one, two or all three banks of elements to be switched on. The hot water is sent through the building by means of duplicate 1 h.p. pumps.

The 6·6 kV supply for the building is provided by the South Western Electricity Board, Bristol Central District (commercial manager: Mr. A. G. Parsons, M.I.E.E.) through a pair of incoming cables and is handled by a group of Crompton Parkinson switches, each of 150 MVA rupturing capacity. The two units for the electrode boilers are equipped with automatic closing gear, the switch controlling the domestic hot water supply (through a British Electric Transformer 150 kVA 6,600/415 V transformer) being arranged for hand closing.

The electrode boilers, pumps, storage vessels and all interconnecting pipework and valves were installed by Sulzer Bros. (London), Ltd., in accordance with the instructions of the consulting engineers, J. Roger Preston & Partners, and as subcontractors to Arthur Scull & Sons, Ltd. The electrical installation was carried out by Grierson, Ltd.



High-voltage switchgear governing the supplies to the electrode boilers and the transformers providing for l.v. services

Starting High-Pressure Turbines

Causes of Rotor Vibration

IN a lecture to the Electrical Power Engineers' Association (London Technical Group) Messrs. J. S. Hall and O. Howarth (Metropolitan-Vickers) recently discussed various problems associated with the design and operation of turbines for steam conditions of 900 lb/sq in and 900 deg F. Their principal theme was the starting of sets with particular reference to rotor vibration.

A low ratio of cylinder-rotor weight was necessary to lessen axial differential expansion between these two main components under temperature changes. The short-term bending of rotors in service could very rarely be ascribed to thermal instability in view of the preliminary stress relieving treatment during manufacture.

On starting a turbine, the rotor must be at a uniform temperature in transverse planes. A cold rotor would thus be straight, but not a stationary hot rotor. Readings taken on the shaft outboard of the inlet end bearing of a 50 MW 3,000 r.p.m. turbo-alternator had revealed an upward bend of the rotor of 0·006 to 0·007in within an hour, assuming the deflection mid-way between the bearings to be two to three times the measured figures. Turning the rotor through 180 deg resulted in its bending upwards by about the same amount in the same time, bringing it straight again. The actual displacement of the centre of the mass might, however, be less than the assumption of a uniform bend would indicate, since most of the bending usually took place in the glands.

Use of the barring gear on shutting down helped the rotor to remain straight and on starting up an indication of whether this was so was given by turbo-visory gear or a simple dial gauge. A slight residual bend while initially running at low speed (" rolling ") was permissible if this were dissipated before increasing speed.

Vibration, presumably emanating from the rotor, seemed to be the usual sign of excessively rapid heating of various parts. Reduction of steam flow reduced both speed and heating rate, but if vibration occurred just above the critical speed this procedure might increase it, indicating the need to establish steady running of the rotor at a lower than critical speed before running up to a speed which should then be above the critical. As the gland part of the rotor was the most sensitive to temperature effects, the reading of turbo-visory gear, located outside the bearings, might indicate a higher centre deflection than actual. The rate at which the rotor took in heat locally and distributed

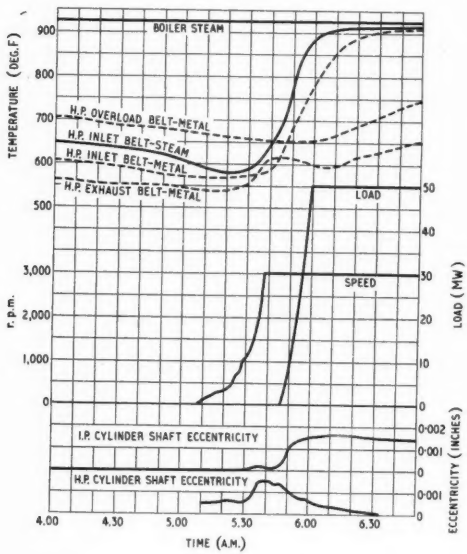


Fig. 1—Run-up of 50 MW turbo-alternator after shut-down of six to eight hours; steam conditions 900 lb/sq in and 900 deg F

it throughout its whole mass was more dependent upon local temperature differences between steam and metal than upon the quantity of steam flowing so long as this was only about 6 per cent of the maximum. Smooth run-up and loading were best obtainable by a relatively large quantity of steam with its temperature controlled to maintain the maximum temperature difference without vibration.

Of the two factors determining temperature difference, that relating to the turbine metal depended on the length of time the machine had been shut down and that relating to the steam on the type of boilers and whether the supply was from a range or on the unit system. Readings from a 50 MW set showed that in six hours after shut-down the inlet belt cooled from 900 to 700 deg F and in thirty-six hours to 280 deg. Corresponding figures for the exhaust belt were 650 to 570 and 200 deg F. The rotor temperature might be taken as about the same as that of the corresponding part of the cylinder. Most of the necessary information could be obtained from an expansion indicator and a thermometer at the inlet metal.

After a shut-down of 6 to 8 hours, as illustrated in Fig. 1, the turbine should be able to accept full temperature immediately. After a longer shut-down heating was slow with the small steam flow necessary for the steam temperature to fall so as to give tolerable temperature differences when it reached the gland portion of the rotor. Increased steam flow, however, would make the rotor liable to bend and its speed to increase. One way of increasing steam flow without corresponding increase in speed was to keep the vacuum as low throughout the run-up as the exhaust casing temperature permitted.

An example of cold-start conditions with controlled steam temperature was shown (Fig. 2). This revealed that speed should be built up as quickly as the behaviour of the rotor permitted, whether steam came from a hot range or under unit conditions. Otherwise starting conditions for the two

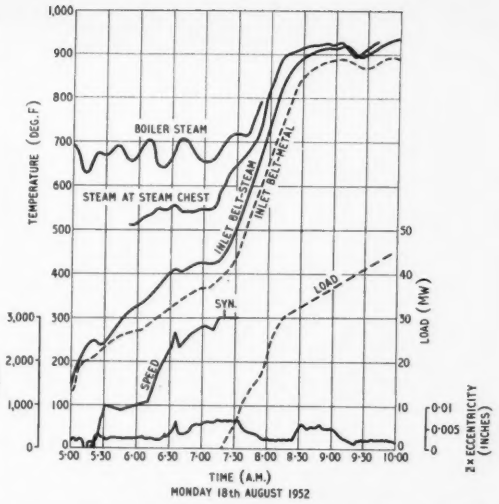


Fig. 2—Starting from cold conditions and subsequent loading of 50 MW turbo-alternator

methods were different. On the unit system the steam available might be colder than the turbine, thus delaying the start. If the boiler characteristics permitted control of steam temperature to suit the turbine throughout running up and loading, the conditions were most favourable. When the turbine was dead cold, prolonged initial soaking at very low speed would be equivalent to range operation after a 24 to 36 hour shut down. Assuming 250 deg F to be a limiting steam-metal difference, a starting time could be derived from Fig. 2 and the corresponding ideal boiler flow-temperature characteristic. Steam pressure during the run-up needed to be high enough only to ensure the requisite temperature. A 50 MW unit machine was run up from near-cold conditions and synchronized about 2¼ hours after the start of rolling.

New Bombay Station Planned

IT is reported in the *Indian Textile Journal* that according to Mr. J. R. D. Tata, chairman of the Tata Power Co., Ltd., the Government of Bombay has finally taken action to increase the generating capacity available for the needs of Bombay. The Tata hydro-electric companies, whose licences are to be extended to 1975, will construct a new thermal station with a maximum capacity of 100 MW.

NEW BOOKS

Electricity in the Home. Edited by G. A. T. Burdett. Two volumes. Pp. 633, plates 36, figs. 621, index. Caxton Publishing Co., Ltd., Hanover Square, London, W.1. Price 75s.

This book, to which nine specialists contribute, deals with the numerous aspects of domestic electrification as far as possible in non-technical terms, although a few pages are given to elementary theory. It should be useful to those engaged in installation work and to the householder wishing to specify approximately the kind of installation he requires. For both kinds of reader the particulars of the types of apparatus and ancillary items available for various purposes should be of service.

It is not suggested that a householder should himself try to make repairs or adjustments beyond the renewal of fuses; rather is he told what to avoid doing, such as using portable apparatus in bathrooms, in a chapter dealing with safety precautions.

The scope of the work ranges from the heavier apparatus, such as cooking and heating, to lighting, television, radio, bells and electric toys, and gardening aids. There are reasoned explanations of charges for electricity, electricity law and official regulations, but no reference to the I.E.E. Regulations for the Electrical Equipment of Buildings. The necessity for compliance with the last is, however, tacitly recognized in various recommendations throughout the book.—C.O.B.

Artificial Light and Photography. By Dr. G. D. Rieck and L. H. Verbeek. Pp. 320; figs. and index. Philips Technical Library. Cleaver-Hume Press, Ltd., 42a, South Audley Street, London, W.1. Price 52s 6d.

This is probably the most complete and precise work yet published on the vast subject of artificial light sources and their application to photography. Its aim is to give everyone who uses artificial light for photographic purposes a theoretical and practical explanation of the possibilities and problems connected with the use of such light sources both for the illumination of the object, the developing of the film and for reproduction purposes in black, white and colour. Every worker, whatever his field, will find in it understanding and knowledge that will enable him to obtain results with confidence and certainty.

The contents of this very finely produced book are classified in eight main sections, each dealing with a widely different group of application aspects, and there is a section analysing and tabulating complete technical data relating to the many fine photographs which illustrate the book.—J.H.H.

Dynasty of Iron Founders. By Arthur Raistrick, Ph.D., M.Sc. (Pp. 308, illus.). Longmans, Green & Co., Ltd., 6 and 7, Clifford Street, London, W.1. Price 30s.

This is the history of the Darby family and the Coalbrookdale Company from the establishment of the business in 1699 by Abraham Darby. Its interest to the student of industrial history will be shared by the general reader for it is an intimate account of the course of development in one of the country's basic industries over two and a half centuries. As such it reflects the ideas of the great ironmasters and their men as well as tracing the great technical advances made during the period.

There is electrical interest, too, albeit somewhat cryptic. A letter written by William Reynolds, one of the family, makes reference to "intended receptacles of Electric Fire" and to "electrical machines" with which, apparently, are connected "the Bells, Thunderhouse, etc."

The Coalbrookdale Company is to-day a member of the Allied Ironfounders group which also embraces Falco Electrical Appliances, Ltd., and the Falkirk Iron Co., Ltd.—J.H.C.

Books Received

Essentials of Microwaves. By R. B. Muchmore. Pp. 236; figs. 201; index. Chapman & Hall, Ltd., 37, Essex Street, London, W.C.2. Price 36s.

Radio and Radar Technique. By A. T. Starr. Pp. 812; figs. and index. Sir Isaac Pitman & Sons, Ltd., Parker Street, Kingsway, London, W.C.2. Price 75s.

La Mécanique Ondulatoire. By T. Kahan and B. Kwal. Pp. 224; figs. 18. 103 Boulevard Saint-Michel, Paris-5e. Price 260 fr.

SODIUM LAMPS

Features of Design and Operation

By E. F. EDWARDS, B.Sc.*

THE present demand for improved street lighting, together with the need for strict economy in the use of power, has led to the widespread use of electric discharge lamps. In particular, the high luminous efficiency of the sodium lamp is making it increasingly popular for street lighting, despite the monochromatic quality of the light emitted.

Lamp Design

To appreciate the form which the modern sodium lamp takes it is necessary to consider some of the processes taking place in the discharge. In designing a high-efficiency light source it is obviously important to ensure that the major part of the energy radiated shall appear as visible light while the infra-red radiation is reduced to the minimum.

An electric discharge in sodium vapour produces, in the main, two strong yellow lines together with a number of much weaker lines in the infra-red region of the spectrum. A characteristic of the yellow sodium lines is that they are strongly reabsorbed by the surrounding sodium vapour. This self-absorption increases with increasing vapour pressures and also in wide diameter tubes, where the vapour path to be traversed by the radiation before final emission may be long. Such self-absorption is not, fundamentally, objectionable since light absorbed in this way will in general be re-radiated in the same form. Other processes taking place in the discharge may, however, interfere with this re-emission and tend instead to produce infra-red lines; the occurrence of these secondary processes increases with increasing current density. Thus, the sodium vapour pressure and the current density together with the arc tube dimensions must be chosen with care in order to reach the optimum luminous efficiency.

The eye is not equally sensitive to radiation of different wavelengths and the maximum sensitivity of the average eye occurs at a wavelength of 5,550 Å in the green region (Fig. 1). If it were possible to convert all the electrical energy in the lamp into light of this wavelength the efficiency would be close to 680 lm/W. The corresponding figure for the yellow sodium line is 475 lm/W and efficiencies approaching this figure have been obtained in experimental lamps in which the required sodium vapour pressure was maintained by external heating.†

For the sake of simplicity, however, a practical light source must be self-contained and some of the power dissipated in the arc must be used to maintain the lamp temperature at the required point. Some compromise in design is therefore necessary

* Research Laboratories, General Electric Co., Ltd.
† Druyvestein, *Phys. Zeits.*, Vol. 33, p. 822, 1932.

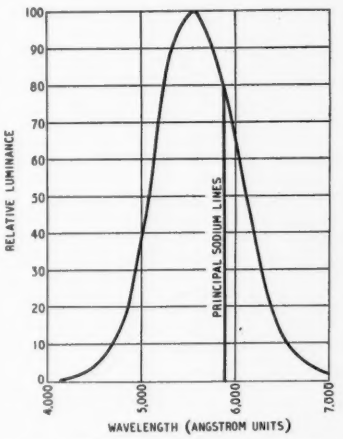


Fig. 1.—Relative spectral luminance curve for the average human eye

and, in establishing this compromise, an initial efficiency of about 80 lm/W is achieved in a lamp of about 140 W rating. These restrictions are found to impose quite narrow limits on arc tube diameter and lamp current. Variations in lamp wattage are therefore most simply achieved mainly by altering the length of the arc tube, which is usually made in the form of a U to keep its overall length within convenient proportions (Fig. 2).

At normal ambient temperatures the vapour pressure of sodium is very low indeed and it is necessary to fill the arc tube with a rare gas at a pressure of about 10 mm of mercury so that the discharge may be initiated. The most suitable gas for filling sodium lamps has been found to be neon at a pressure of about 10 mm of mercury and, to reduce the initiation voltage, a trace of argon is usually admitted to the lamp with the neon. At first the discharge takes place entirely in the gas and sodium radiation is absent. The energy so dissipated warms the arc tube, with a consequent increase in the sodium vapour pressure, and the sodium radiation, until equilibrium is reached at a temperature of about 280 deg C. At this temperature the sodium vapour pressure is about 5×10^{-3} mm of mercury and the sodium light constitutes some 95 per cent of the visible radiation from the lamp. The manner in which the light output varies with time during the run-up period is indicated in Fig. 3.

To ensure that the minimum of energy shall be expended in maintaining the arc tube at a suitable temperature and to render the lamp less sensitive to changes in ambient conditions, conduction and convection losses are reduced by enclosing the lamp in a double-walled glass jacket, the space between the walls being evacuated. This type of construction enables the lamp to be thermally insulated from its surroundings and helps to maintain an even temperature distribution along the arc tube. The evacuated double walled jacket may be used repeatedly and may almost be regarded as part of the fitting.

An essential feature of the sodium lamp

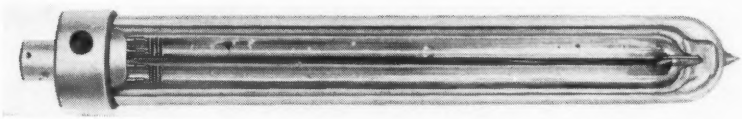


Fig. 2.—Typical 140 W sodium lamp

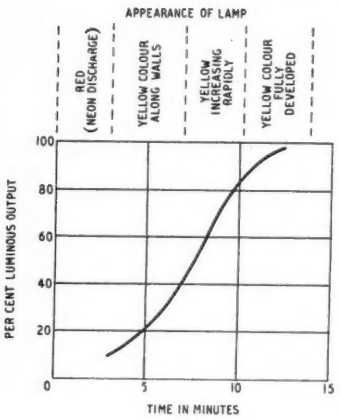


Fig. 3.—Lumen output during warming-up period

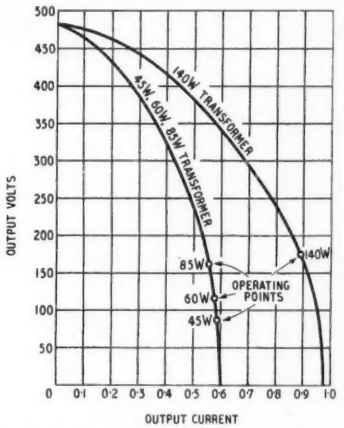


Fig. 4.—Leakage reactance transformer characteristics

is the special glass used to form the arc tube. Sodium is chemically a highly active element and, at the temperature reached in a sodium lamp, readily attacks the usual glasses, which contain a high proportion of silica. This attack would produce with such a glass a rapid fall in luminous efficiency together with disintegration of the arc tube. It was discovered that glasses in which the silica had been largely replaced by boric oxide would withstand sodium attack, but such glasses are unstable when exposed to the atmosphere and are obviously unsuitable for a discharge lamp envelope. The difficulty has been overcome by manufacturing a two-ply glass consisting of a thick walled tube of a normal lime-soda glass with a thin layer of sodium resistant glass on its inner surface. The thermal expansions of the two glasses must be carefully controlled to prevent cracking during processing or in use.

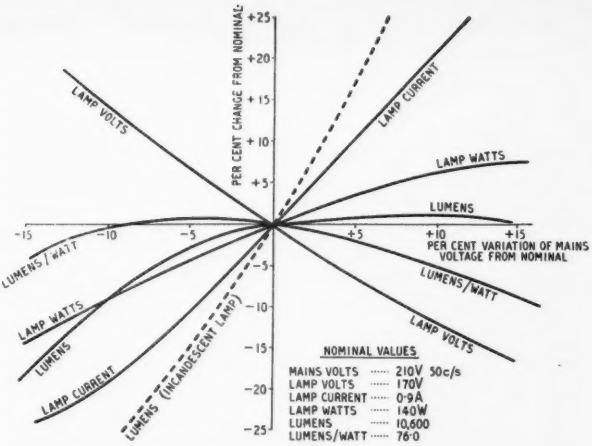


Fig. 5.—Variation of 140 W sodium lamp characteristics with mains voltage

Attack by the sodium may also take place along the metal-glass interface of the seals which carry the current into the lamp and this may be complicated by electrolysis caused by leakage currents through the hot glass between the wires and the arc. Careful choice and processing of the glass-metal seal has reduced the rate of attack to the minimum and the electrolysis problem has been met by the use of lead wires sheathed with a specially designed glass of high electrical resistivity.

Not the least of the problems facing the sodium lamp designer has been the development of suitable electrodes. These are required to operate under the rigorous conditions of a cold start in an atmosphere of neon and must be small, simple and inexpensive. Much effort has been expended on the problem in the past few years and it is now bearing fruit in increased reliability.

The sodium lamp, in common with most other discharge lamps, must be operated in series with a stabilizing impedance. Furthermore, voltages higher than the usual mains voltage are required both to initiate and maintain the arc, at least in the larger lamps. These two requirements are satisfied in practice by operating the lamps from a leakage reactance autotransformer. The characteristics of two transformers of this type are illustrated in Fig. 4.

Initially the transformer applies about 480 V to the lamp and as soon as the arc is started, this secondary voltage falls and the tube current rises until the operating point is reached. In the 140 W sodium lamp, the tube voltage in full operation is about 170 V and the tube current 0·9 A. The 45 W, 60 W and 85 W lamps all operate at about 0·6 A and differ only in their tube voltages. The shape of the leakage reactance transformer characteristic makes it possible to operate lamps of these three ratings from the same transformer without resetting and with only minor deviations from the objective wattages.

The overall uncorrected power factor of lamp and transformer is only about 0·3, but this is corrected to about 0·85 in the usual way by means of a capacitor connected across the primary of the transformer.

Because of the time required for the sodium vapour to reach its correct pressure, full light output is not realized immediately

after switching on the lamp. The arc tube takes an appreciable time to reach its final operating temperature and during this time the light output increases steadily and the colour of the light changes from the red of the neon to the yellow of the sodium discharge. Equilibrium is reached ten to fifteen minutes after switching on. During the run-up period the arc voltage falls and the arc current increases as the sodium vapour pressure rises. This is due to the fact that the ionization voltage of sodium is very much lower than that of neon, so that a lesser voltage gradient in the arc is sufficient to maintain the required arc current.

The effects of mains voltage fluctuations on the operating characteristics of the sodium lamp are shown in Fig. 5. The combination of transformer and lamp characteristics renders the lumen output of the sodium lamp much less sensitive to mains voltage fluctuations than that of the tungsten filament lamp, which is included in Fig. 5 for comparison.

It is clear that interest in the use of sodium lamps for street lighting is being maintained and has given a strong stimulus to research in this field. Such research, aided by the development of rapid forced-testing techniques, has led in the past few years to a considerable improvement in both the efficiency and reliability of sodium lamps. There is no reason to suppose that we have yet reached the limits to these improvements and development work continues on this interesting, if technically difficult, discharge lamp.

Lighting and Colour

Creating "Visual Interest"

IN a paper submitted last week by Mr. David Medd, A.A. Dipl., A.R.I.B.A., at a meeting of the Illuminating Engineering Society in London the author stressed the now familiar plea for closer collaboration between the lighting engineer and the architect in the early design stage. Architects needed to take advice on the best way of achieving the right quantity and quality of lighting, and colour choice was not entirely the prerogative of the architect or decorator. The architect wanted to feel that he was free to design in terms of light and shade, with certain æsthetic considerations in mind. Brightness contrasts that would be intolerably disabling in certain spaces might be quite justifiable in others. Architects saw in "brightness engineering," particularly as exemplified by American engineers, a restrictive attitude of mind which in attempting to remove any possible cause of discomfort would result in dull spaces which, at best, would be good only for sleeping in.

There were signs that designers were realizing that modern architecture was starved of visual interest and that a form of decoration and enrichment must be established which sprang naturally from present-day materials, techniques and economy. The provision of visual interest was made easier by exploiting a wide range of textures, colours and materials. The device of contrast to produce visual interest was one that could be used more. The scope was vast and insufficiently appreciated by many designers. Architects would not achieve visual interest in buildings until they were able to use the whole scale.

In rooms or spaces where good vision was of prime importance the architect, with the help of the lighting engineer, must deploy the light sources, both natural and artificial, to ensure not only adequate illumination whenever required, but a balancing of sources to avoid brightness contrasts that would cause disability or discomfort. He must also realize the effect of these sources on the reflectances of colours he would be using. There were many other parts of buildings where the architect could be a little more bold, daring, or dramatic in his use of daylight.

The paper also dealt at some length with the effect of building design on the choice of colour schemes and described the range of colours for use in schools evolved by the Ministry of Education, use of which, however, was not compulsory.

Southern Rhodesian Electricity Supply

Commission's Report for 1951-52

By DOUGLAS SPENCER

DURING the year ended March 31st, 1952, there was an increase of 21·29 per cent in sales of electricity by the Electricity Supply Commission of Southern Rhodesia, compared with 18·52 per cent in the preceding twelve months, i.e., from 259·7 million to 315 million kWh.

As was forecast in the previous report of the Commission, the total sales were greatly increased by the installation of the 88 kV line from Gatooma to Salisbury, to relieve the latter city's power shortage. With this increased supply the total sales reached 355 million kWh, an actual increase of 36·59 per cent. The agreement with Salisbury will remain in force for another four years, by which time, it is anticipated, the city will have its additional power plant installed.

The installed plant capacity at all generating stations was 82,370 kW, and a further 102,500 kW is on order or under construction. Transmission and distribution systems increased by 740 route miles, to 5,488 route miles of line.

The total revenue rose by 31·18 per cent, from £951,074 to £1,247,589, but the profit at £57,879 was £7,439 less than in the previous year. The amount of coal consumed was 234,011 short tons as against 171,373 tons. The cost of coal increased by 39·39 per cent. The average cost of coal per kWh sold from the Commission's own generating stations was 0·243d, as compared with 0·246d in the previous year.

There is, however, a threatened increase of 8s per ton in the price of coal from the Wankie Coal Company, to enable the company to pay more than 5 per cent on its capital and thus facilitate the raising of new funds.

The various items which went to make up the total production cost of £1,189,710 were proportioned as follows (per cent):—Interest, 19·6; redemption fund, 6; reserve fund, 5. Generation: Fuel, 24·1; operation and maintenance, 12·1. Distribution: Operation and maintenance, 7·4. H.Q. administration and engineering expenses, 5·2; local administration, 6·8. Electricity purchased, 13·8.

The total capital expenditure at 31st March last was £10,195,897, and it is anticipated that a further expenditure on capital account of £9½ million will be incurred by 31st March, 1955.

The report contains some interesting remarks on the elasticity (upwards) of contract prices. For a 20 MW unit the tendered price in November, 1945, was £138,000, but statutory increases brought the price up to £177,755. In January, 1952, a duplicate set was ordered at £229,810, still with the possibility of the addition of statutory increases.

The Commission seems quite satisfied with the general tariff structure, but issues a warning that it intends to apply to the Electricity Control Board to increase the minimum monthly charge in the farming tariff before general tariff increases are considered. This seems fairly reasonable in view of the fact that far too many farmers still confine the use of electricity to domestic requirements. This is probably due to the number of tobacco farmers connected up, who are not engaged in food production and so have not installed motors for grinding meal, preparing fodder, irrigating green crops for cattle, and for pumping water supplies over a large area. It is to be hoped that the charges for food production farmers will not be increased, even though the minimum monthly charge for those who only use power for domestic purposes might reasonably be put up.

At the end of March last, 1,565 farms were connected to E.S.C. main lines, while the total of licensed farmers in the country is something over 5,000. Farmers require licences if working 50 acres of land or more. On the larger farms, which in the main are of 1,500 to 3,000 acres, in the red soil areas producing food, electricity is very fully used, and the range of electrical plant is quite wide, including a 20 h.p. motor for

grinding meal, several motors, large and small, for pumping, and possibly several much larger ones for irrigating dry weather crops such as potatoes and lucerne, in addition to small motors for drills, lathes, etc. Numerous domestic appliances are now in wide use in farmhouses, such as electric boilers, washing machines, fans, cooking stoves, sweepers, refrigerators, radio sets and floor polishers.

Those firms whose main offices and stores are in Johannesburg should note that this town is a thousand miles away from Southern Rhodesia and that the latter self-governing Colony is not in South Africa. The writer's own purchases are made from a firm which has long been established in Salisbury, the only British firm, as far as he knows, which does not work with Johannesburg as a main selling base.

As regards the sales of electrical plant for domestic and farm purposes the Commission's report contains this interesting note concerning the joint selling effort in Umtali. "The Umtali service centre proved to be so popular that the Commission, Municipality and participating merchants agreed to operate it for a further period." There would appear to be a similar opportunity in such places as Rusape and Marandellas, both of them situated in sand veld areas where the soil is more suited to tobacco growing than to food production, but where tobacco is bringing in very fine returns to the grower.

The development of hydro-electric power in the near future would appear to depend on the realization of the scheme for the federation of Southern Rhodesia, Northern Rhodesia and Nyasaland. In view of the tremendous tonnage of coal which has to be carried to the copper mines of Northern Rhodesia, the large towns and tobacco growers of Southern Rhodesia, the limitations imposed by a single-track trunk line serving such a large area are serious. The development of water power, first on the Kafue and Zambesi Rivers, should, if federation is achieved, without doubt have one of the first claims on the large amounts of capital which will have to be raised in such a quickly developing territory.

Coal Industry Reconstruction

PROGRESS made in the modernization of the coal industry was surveyed by Mr. E. H. Browne, director-general of production, National Coal Board, in an address at Doncaster last Saturday.

Mr. Browne said that since vesting day 124 major schemes costing about £142 million had been authorized but only £80 million of this sum had been planned in sufficient detail for the actual expenditure to be authorized. Of £70 million authorized for actual expenditure by last June, only £25 million had been spent and only £15 million worth of work was represented in uncompleted contracts or in jobs started but not finished. Thus there was £30 million worth of work not begun or placed out to contract.

Five new shafts had been completed; nineteen were being sunk and three more were approved but not yet started. Thirty shafts had been deepened and seventeen more were being deepened. Shaft sinking and the provision of winding engines were two of the longest delay factors in new schemes.

The Board now had twelve skip winding installations; eight more were under construction and many more were planned. Experimental work was being done on winding with containers which were moved only from a loading point at the shaft into the cage and emptied at the shaft top. Referring to the useful field to be developed in automatic electric winding, Mr. Browne thought that too many accidents occurred due to human errors. This was surely a case where safety, as well as economy, could be developed by automatic control, the banksman operating the winding engines.

The total electrification of a colliery sometimes closed an outlet for inferior fuels and in these cases there might be a case for a pithead power station. The Board had agreed with the British Electricity Authority to share the erection of these stations. One was being planned by the Authority for Ayrshire and another by the Board for Yorkshire.

A common feature of most new projects was locomotive haulage. The number of locomotives had increased from about 80 at vesting day to 510, of which 450 were diesel and 60 battery driven. There had been a tendency to over-provide accommodation at pit bottoms when storage could be cheaply provided by locomotive haulage and elaborate excavations could be replaced by simple forms of car handling. The Swiss-developed electro-gyro locomotive was being watched with interest; trials were to be carried out on the surface with an eye to possible use underground.

VIEWS on the NEWS

By REFLECTOR

I AM glad to see that John Gordon, in the *Sunday Express*, has retracted his criticism of Lord Citrine in connection with the recent appointment of a divisional controller (see my note of 6th February). He acknowledges that Lord Citrine is not personally responsible for such appointments and that any suggestion that Lord Citrine uses his position to stifle criticism is "clearly unwarranted." Mr. Gordon says his criticism was not meant to be personal but was directed against the B.E.A., as a public corporation. He is still dissatisfied with the appointment, however. Without being conversant with the merits of this particular case I would say that it was all to the good that the B.E.A. should decline to be bound by precedent when making such appointments.

* * *

In my comments on the *Manchester Guardian* correspondence on the dirty state of British railway stations (*Electrical Review*, 6th February) I suggested that electrification might provide a cure. Actually this view was put forward in a letter sent to the *Guardian* by Mr. S. McCracken, M.I.E.E., of Belfast, but the letter was apparently crowded out. The writer pointed out that not only would electrification enable stations to be kept clean, it would also result in an annual saving of about 10 million tons of coal which could be exported. In fact, he said, we could not afford *not* to electrify the railways.

* * *

Fish appear to be having an increasing influence upon the operations of electricity supply authorities. Recently Mr. Thomas Johnston, chairman of the North of Scotland Hydro-Electric Board, said that his Board had gone to some expense in stocking its lochs with salmon and destroying pike and eels. A technical member of the Board's staff gave particulars of methods of electrically controlling the movement of salmon and trout in the Highland rivers to prevent them getting into the water turbines. In England trouble has arisen from the raising of the temperature of streams by ejected cooling water and the B.E.A. is having difficulty in meeting the objections of river authorities and anglers.

* * *

Complaints of increased electricity charges are frequent nowadays but a rise from 15s to £17 12s in the annual lighting bill for a Yorkshire cemetery chapel is a little out of the ordinary. When the cause was investigated it was found that a vagrant had made the chapel his sleeping quarters and had been in occupation at night for several months. Even so quite a lot of light can be obtained for over £17 a year; there surely must have been a cooking and heating load as well.

* * *

There is an aspect of block electricity tariffs which, I confess, is new to me. It is revealed in a quotation by *Southern Electricity* of some remarks by the chairman of a Gas Consultative Council:—

> "It is none of our concern except that it does affect the gas consumer because he cannot use up ten units a room on lighting and has therefore to use other electrical appliances in preference to gas appliances in order to become entitled to the cheaper rate. It acts as a deterrent to the gas industry and places the gas consumer in an unfair position."

* * *

An electric fire which is rendered "dead" when it falls or is knocked over is mentioned in the *Yorkshire Evening News*. This American appliance is said to have a fuse which is melted by the heat when the fire is lying on its face. Nothing is said about what happens when it falls the other way. Anyhow there is at least one British fire which is switched off when it is tilted beyond a certain angle and restored upon regaining the upright position—so why go to America for safety ideas?

Engineering Training

Present Facilities Inadequate

PRACTICAL and theoretical aspects of the manner in which engineers are trained in Great Britain were surveyed by Sir Arthur P. M. Fleming in a lecture he delivered last week to the Manchester Association of Engineers. Following an introduction concerned mostly with causes and effects, Sir Arthur proceeded to define professional engineers, technicians and craftsmen, outlining the qualifications required of each, the kind of work each was expected to do and the different manner in which each class could best be trained for the task to be undertaken, not forgetting that as industry had become more and more complex the need had increased enormously for ensuring efficient and capable management at all levels.

Teaching British Methods

After thus considering changes in training which had been imposed by changes in industrial conditions, Sir Arthur outlined the effect of commercial developments, particularly those relating to export markets. He mentioned that during a visit he paid recently to nine Latin American countries he had found overwhelming evidence of the need for trained engineers. Those countries were in a state of early industrial development and they needed engineering facilities to provide transport, roads, railways, communications and power. The time was therefore now ripe for young graduates from those countries to come to England to be trained in British methods and to obtain knowledge of British products, so that in the present period of development in their own countries British plant and equipment might be used. In the training of such young men from overseas it was of importance that the social side of their stay in this country should not be overlooked. They should return home not only trained in the knowledge of British engineering equipment but also with the friendliest feelings towards Britain so that they would, in turn, induce other young men to come here for training. In that way important channels of export trade could be opened up and this matter of training overseas graduates as part of the British export drive should be reviewed from the national standpoint. It was not enough to leave the provision of training places to a few large engineering firms.

Looking to the future of engineering training, certain trends were discernible. Foremost was the need for increased technical personnel at the highest levels. Technologists able to apply new scientific discoveries to industrial purposes represented the " cutting edge " of the industry and without them in adequate numbers this country could not hope to keep her industries in the forefront of world progress. A great deal of thought was being given to the provision of better facilities for the training of higher technologists in this country. The facilities were at present inadequate and so too were the numbers of young people with the right educational background who were coming forward for such training. Improvements in the national system of education which were now taking place would help to remedy this deficiency, but this country was still a long way from achieving the ideal of giving to all our young people the best opportunities that their inherent talents merited.

SWEDISH TELEVISION COMMISSION

THE Swedish Minister of Communications has appointed a Commission to study the possibility of introducing a television service. The members are: Mr. O. Sehlstedt (Member of the Swedish Parliament), Mr. E. Esping (Director, Department of the Board of Swedish Telegraphs), Mr. A. Berger (Permanent Secretary, Swedish Ministry of Communications), Mr. E. Mattsson (manager, AB Radiotjänst), and Mr. H. Nyström (manager, Swedish Electrical Manufacturers' Association). The secretaries are Mr. H. Hahr (AB Radiotjänst) and Mr. T. Rosenlund (Board of Swedish Telegraphs). The Commission is now visiting this country and members will study the British Broadcasting Corporation's Television Service; they will also see British television equipment being manufactured.

PERSONAL and SOCIAL

News of Men and Women of the Industry

THE Council of the Royal Society has appointed **Sir James Chadwick**, F.R.S., as the Rutherford Lecturer for 1953. He will deliver the lecture at McGill University, Montreal, in the autumn. This is the second Rutherford Lecture to be delivered under the terms of the Rutherford Memorial Fund.

Mr. A. M. Manighetti, M.I.E.E., A.M.I.Mech.E., informs us that he is sailing from Southampton on 10th March for the British West Indies. His visit will be principally in connection with electricity distribution for the Trinidad and Tobago Electricity Commission.

Mr. F. R. Livock, T.D., B.Sc.(Eng.), M.I.E.E., A.M.I.Mech.E., has been appointed controller, education and personal services, General Electric Co., Ltd., and **Mr. G. B. L. Chivers**, B.Sc., A.K.C., has been appointed staff manager of the sales organization.

Mr. Livock was educated at Berkhamsted School and University College, London. He served a graduate apprenticeship with Metropolitan-Vickers, subsequently joining the staff as a junior engineer. In 1933 he joined the G.E.C. sales organization in Manchester and served as a departmental manager until he was called-up as a Territorial officer in 1939. He was demobilized in 1945 with the rank of lieut.-col., and rejoined the G.E.C. in London as staff manager. He is a member of a number of committees concerned with education and training; he has recently returned from a tour of Latin America as a member of the F.B.I. Engineering Training Mission.

Mr. Chivers was educated at Richmond County School and King's College, London; he graduated in physics and mathematics in 1939 and secured the Teacher's Diploma. During the war he was a flight lieutenant (meteorological officer) in the R.A.F. On demobilization in 1946 he joined the G.E.C. Research Laboratories, Wembley, as staff manager, a position which he has held for the past six years.

Mr. F. R. Livock

Mr. G. B. L. Chivers

Mr. C. H. Flurscheim has been appointed assistant chief electrical engineer in addition to his present duties. Mr. Flurscheim was educated at Wellington College and Trinity College, Cambridge. He joined the Metropolitan-Vickers Co. as a college apprentice in 1927 and afterwards joined the staff of the Switchgear Engineering Department. During this time he spent a year with the General Electric (U.S.A.) as an I.G.E. fellowship student. In 1936 he took over the high-voltage division of switchgear engineering. During the war period he was responsible for the development of a series of electrical components for aircraft, including electro-mechanical undercarriages, retraction units and miniature circuit breakers. In 1945 he became assistant chief engineer, and in 1949 chief engineer, Switchgear Department. Mr. Flurscheim has read many papers before the Institution of Electrical Engineers and other technical institutions.

Mr. C. H. Flurscheim

Mr. C. H. Flurscheim, B.A., M.I.E.E., Mem.A.I.E.E., chief engineer, Switchgear Department, Metropolitan-Vickers Electrical Co., Ltd., has been

Mr. A. J. Nicholas, a director of South Wales Switchgear, Ltd., is shortly leaving for a tour in connection with export business in India, Australia, Canada and the United States.

Mr. F. Green has been appointed to represent South Wales Switchgear, Ltd., in South West England. He will be based at Bristol. Mr. Green has been with A. Reyrolle & Co., Ltd., Brookhirst Switchgear, Ltd., and Asea Electric, Ltd., as a designer and engineer of control gear, switchgear and supervisory equipment. Latterly he was with the

Military Government in Germany as a controller of electrical industries in the Aachen area of the British Zone.

Mr. I. Stedeford, chairman of Tube Investments, Ltd., left by air for South Africa on 17th February for consultations with associate and subsidiary companies, and to observe at first hand general industrial trends in the Union. During a three-week stay he will also visit Rhodesia.

Mr. D. G. Clarke, A.M.I.E.E., has been appointed deputy power station superintendent at the new East Yelland generating station of the South Western Division of the British Electricity Authority, with effect from 16th March next. Before this appointment Mr. Clarke was operation and efficiency engineer at Bromborough power station, Merseyside and North Wales Division of the B.E.A.

The **Ex. J. & P. Association** will be holding its sixth annual dinner and reunion at Grosvenor House, Park Lane, London, W, on 7th March. Mr. W. F. Smith, the Association's secretary, will be pleased to hear from any former members of J. & P. wishing to join the Association. His address is :—66, Coleraine Road, Blackheath, London, S.E.3.

About 350 members and friends of **Johnson & Phillips, Ltd.,** were present at the Woolwich Town Hall last Friday evening to witness the presentation of awards to the company's outstanding students of the year. Mr. G. L. Wates, J.P., chairman of the company, said that since the first "apprentices' night" held last year, the company had introduced a new feature into their education scheme, whereby a trade apprentice could be up-graded to the supervising class of engineering apprentice if he qualified at a sufficiently high level before the age of twenty. This would enable more apprentices who had the necessary basic training to reach graduate membership of the professional institutions. Among those apprentices who received awards were Mr. R. H. Ansell, best junior trade apprentice of the year and Sub-lieut. G. L. Varley (R.N.V.R.), the best engineering apprentice.

Mr. G. L. Wates presenting an award to Sub-lieut. G. L. Varley, R.N.V.R.

The annual dinner and dance of the North Eastern Centre of the **Institution of Electrical Engineers** was held at the Old Assembly Rooms, Newcastle-on-Tyne, on 12th February, when the guests were received by the president of the Institution, Col. B. H. Leeson, and Mrs. Leeson, and the chairman of the North Eastern Centre, Mr. H. Leyburn, and Mrs. Leyburn. Over 200 members with their wives and guests attended the dinner and many of the Students' Section members joined in the dancing later. The toast of the Institution was proposed by the new Rector of King's College, Dr. C. I. C. Bosanquet, who mentioned the contribution which universities had made to the industry by training engineering students. He also referred to the valuable assistance which the College received from the electrical industry in the North and through the good offices

At the annual dinner of the North-Eastern Centre of the Institution of Electrical Engineers showing Col. B. H. Leeson (president) and Mrs. Leeson greeting Ald. W. McKeag, behind whom are Mr. H. Leyburn and Mrs. Leyburn

of the Institution members. Col. Leeson, in reply, confirmed that the need was for even greater numbers of trained engineers, both from universities and technical colleges. The civic authorities of the city were represented at the dinner by ex-Lord Mayor, Ald. W. McKeag, deputizing for the Lord Mayor and, in the unavoidable absence of the Sheriff, the Sheriff's Lady, Mrs. W. Temple. The reply to the toast of the guests, proposed by Mr. E. C. Rippon, past chairman of the Centre, was responded to by Mr. O'Herlihy, chairman of the Northern Counties Association of the Institution of Civil Engineers.

Mr. M. Trickett, station superintendent at the Hareholme power station, Rawtenstall, North Western Division, B.E.A., retired on 29th January after forty-three years' service in the industry. Mr. Trickett was appointed power station superintendent in 1930. **Mr. J. Alker,** deputy station superintendent at Wigan, has been appointed to succeed Mr. Trickett as station superintendent at Hareholme. **Mr. J. Stephen,** who has been station superintendent at Chamber Hall, Bury, since 1913, retired on 14th January. He was formerly assistant station superintendent at Wigan (Bradford Place) station. He is succeeded at Bury by **Mr. J. H. McCaghey.**

Mr. G. H. Peregrine, Swansea, has been appointed regional manager for Central and Northern Africa and the Middle East for Hoover, Ltd., and he left last week-end on a business air tour of Egypt, Lebanon, Syria and Malta.

Mr. J. W. Tonking has been appointed a director of the Lightfoot Refrigeration Co., Ltd.

In consequence of a major operation, **Mr. G. B. Morrison,** London and Home Counties representative of the Universal Boilers & Engineering Co., Ltd., is not expected to return to duty for several months.

To mark his fiftieth year with the Electric Construction Co., Ltd., **Mr. H. Jackson,** deputy foreman, machine erection shop (small and medium size machines), was recently presented by Mr. W. M. B. Furniss, assistant managing director, with a gift of savings certificates from the board.

Mr. W. V. Wright has been appointed general manager of the land boiler division of John Brown & Co., Ltd.

The **Telcon Staff Association** of the Telegraph Construction & Maintenance Co., Ltd., and Submarine Cables, Ltd., held their fifth annual dinner-dance at the Dorchester Hotel, London, on 12th February. Mr. W. R. Martin, personnel manager and chairman of the Council, presided over a gathering of 400. Dr. H. H. Scholefield, research manager, metals division, proposed the toast of the company, and Mr. W. F. Randall, director, responded. Mr. J. Innes, C.B., director, proposed the toast to the Association, to which Mr. Martin replied. Among those present were Mr. B. H. Musgrave and Dr. E. W. Smith, directors, Mr. R. W. C. Reeves, director of Johnson & Phillips, Ltd., and Mr. F. Leighton, Telcon works manager. Greetings were cabled by Mr. J. N. Dean, managing director of Telcon, from the Selborne gutta percha plantation in Malaya, where he was spending a few days before continuing his business trip to Australia.

The **Horsley Towers Club,** in co-operation with the Surrey Committee of the Electrical Industries Benevolent Association, is holding a public garden fête on 27th June next at Horsley Towers, and many attractions are being planned.

OBITUARY

Mr. Alan Paul Good, deputy chairman of the Brush Aboe group of companies, chairman of Associated British Engineering, Ltd., and chairman of the Heenan & Froude group, died in South Africa on 10th February. Mr. Good was educated at Marlborough and Oxford where he took his law degrees, and later became a partner of Pennington & Son, solicitors. He left law for commerce, and by 1935 he had started to confine his activities almost exclusively to engineering. He was the principal architect in the formation of the Brush Aboe group which to-day consists of the Brush Electrical Engineering Co., Ltd., and Associated British Oil Engines (Mirrlees, Bickerton & Day, Ltd., Petters, Ltd., J. & H. McLaren, Ltd., the National Gas & Oil Engine Co., Ltd., and Henry Meadows, Ltd.). In 1947 he acquired the controlling interest in Petters, Ltd., and in the same year was elected a director of Mirrlees, Bickerton & Day, Ltd. At about the same time he was asked by the Brush Electrical Engineering Co., Ltd., to help in their refinancing, one result of which was the transfer of Petters business from Yeovil to Loughborough. He was made deputy chairman of the Brush Co. in 1939 and was given executive responsibility in 1941, when he was appointed chairman of the executive committee and subsequently managing director. In 1944 he acquired control of J. & H. McLaren, Ltd., and in the following year of Mirrlees, Bickerton & Day, Ltd. An interest in the National Gas & Oil Engine Co., Ltd., was acquired in 1948,

The late Mr. A. P. Good

and he became a board member the following year. He controlled the group as deputy chairman and managing director of the Brush Electrical Engineering Co., Ltd., the parent company. Ill health compelled him to relinquish some of his responsibilities and in October last year he resigned his managing directorship. He remained deputy chairman and continued to take an active interest in the affairs of the companies. Mr. Good went to France to convalesce last year and returned home shortly before Christmas. He left for South Africa at the beginning of January.

Captain N. Martin.—The death occurred on 12th February at the age of sixty-nine at Kidderminster, of Captain N. Martin, B.Sc., M.I.C.E., M.I.E.E., formerly general manager, Midland Section of Richard Thomas & Baldwins, Ltd. Captain Martin was educated at Allan Glen's School and graduated as a B.Sc. in both civil and electrical engineering at Glasgow University. During the 1914-18 war he served with the Royal Flying Corps and in the R.A.F.

The late Capt. N. Martin

In 1930 he was appointed general manager (Midland Branch) of Baldwins, Ltd., and nine years later he was appointed a director of the company. In 1945, when Richard Thomas & Co., Ltd., merged with Baldwins, Ltd., Captain Martin was appointed to serve on the board of directors of Baldwins (Holdings), Ltd.

Mr. S. R. Witt.—The death occurred in the Middlesex Hospital, London, on 12th February at the age of forty-eight, of Mr. Stanley Reuben Witt, B.Sc., A.M.I.E.E., superintendent of the transformer factory of the British Thomson-Houston Co., Ltd. Mr. Witt was educated at the Latymer Upper School and University College, London, receiving the B.Sc. (Eng.) degree with first class honours in 1925, the college engineering diploma with distinction and the prize in electrical engineering. He joined the B.T.H. Co. as a student apprentice, and was awarded a B.T.H. fellowship with the G.E. Co. (U.S.A.) in 1928. In 1933 he left the B.T.H. Co. but returned in 1935, first as assistant superintendent of the home appliance factory, and then, until 1940, he held a similar appointment in the small gear factory. For the remainder of the war years he was superintendent of other B.T.H. factories engaged on war work. In July, 1945, he was appointed superintendent of the B.T.H. transformer factory.

The late Mr. S. R. Witt

Mr. S. W. Scrivener, director and technical manager of London Electric Firm, Ltd., until his retirement in 1949, died on 7th February. He was largely concerned with the early development of span wire suspension equipment for street lighting, and two of the largest searchlights in the world were designed in 1928 and built under his supervision.

Mr. Ernest B. Hall, chairman and governing director of Hall & Pickles, Ltd., electric resistance wire manufacturers, Manchester, died on 11th February.

WILLS

Mr. A. H. Hoggins, director of Walsall Conduits, Ltd., who died on 22nd July last, left £15,822 gross (£14,201 net).

Mr. J. C. Farebrother, a director of Avon Electrical Services, Ltd., Stafford, who died on 27th October last, left £3,709 gross (£2,865 net).

Mr. C. W. Wood, late lighting equipment engineer with the B.T.H. Co., who died on 9th November last, left £2,479 gross (£2,437 net).

Mr. E. W. Edwardson, J.P., A.M.I.E.E., managing director of E. W. Edwardson & Co., Ltd., who died on 24th September last, left £32,740 gross (£31,553 net).

Mr. J. N. Robertson, M.I.E.E., manager of the Derbyshire and Nottinghamshire Sub-Area of the East Midlands Electricity Board, formerly local manager of the Derbyshire and Nottinghamshire Electric Power Co., who died on 11th October last, left £5,685 gross (£5,580 net).

Mr. J. B. Kramer, M.I.E.E., M.I.Mech.E., F.R.S.A., M.R.I., scientist and inventor, a pioneer in the field of magnetism as applied to industry, who worked in collaboration with the G.E.C. for thirty years and who died on 28th July last, left personal estate in England and Scotland valued at £10,647.

Mr. D. MacArthur, A.M.I.E.E., a director and general sales manager of Metropolitan-Vickers Electrical Co., Ltd., chairman of Newton Victor, Ltd., and of Newton & Co., and a director of Metropolitan-Vickers G.R.S., Ltd., Metropolitan-Vickers, South Africa (Pty.), Ltd., and Sunvic Controls, Ltd., who died on 7th October last, left personal estate in England and Scotland valued at £42,024.

Mr. J. F. Driver, D.L.C., M.I.Mech.E., M.I.E.E., editor and a director of *Machinery Lloyd*, and formerly for many years head of the Department of Electrical Engineering at Loughborough College, who died on 28th October last, left £5,885 gross (£5,794 net).

Industry and the House

What is Fuel Efficiency?

By A. M. F. PALMER, A.M.I.E.E., M.P.

MONDAY is fuel and power question day in the House of Commons and we then have the always interesting spectacle of a Minister undergoing interrogation by Members under circumstances where curiosity is often linked with varying degrees of special knowledge and interest. Solid fuel is not without its devoted advocates as was demonstrated again when a week ago Mr. Lloyd answered a string of questions on the progress made so far with the Ridley Report recommendations.

Performance of Solid Fuel Appliances

Mr. Nabarro, for instance, wanted to know what arrangements the Minister had made to encourage production of solid fuel burning domestic appliances with "standards of performance" based on "achieving a room efficiency of 40 per cent." Realizing in all humility the many and varying assumptions that can be made to decide comparative heating efficiency, it might seem to some an extraordinary abandonment of scientific caution to demand appliances guaranteed to bring about a result measured in so exact terms, but then the Commons is an extraordinary place.

"Caution" had obviously been the watchword given to the Minister by his advisers and he tactfully pointed out that marks to indicate efficiency levels must be based on known and agreed standards; there was still a marked gap between the test bench and everyday performance of solid fuel appliances.

Mr. Lloyd had appointed a small committee of the main industrial interests concerned to work out the practical details of the fuel efficiency advisory services recommended by the Ridley Committee. Loan schemes for fuel efficiency apparatus were being discussed with appropriate departments; extended shift working and the training of stokers were being taken up with the Minister of Labour. The Minister of Education had been asked to look at the possibility of extending facilities for education in fuel technology.

None of this, however, seemed to satisfy the expert-mindedness of Mr. Nabarro, which quality would at times, I am sure, win the admiration of Mr. Stephen Potter. He demanded that the Minister should tell the House "unequivocally" that the new special committee on the advisory fuel services would report "within a month." The collective eyebrows of the House were raised at such shocking presumption; Mr. Lloyd said reprovingly that it was more important to get people "to agree" than to issue "dictatorial decrees." His mental thirst for "dynamic action" still unslaked, Mr. Nabarro flew like an angry arrow to the evergreen resort of the frustrated questioner; he gave notice that he would raise the "unsatisfactory nature" of the Minister's answers on the Adjournment.

Steel Industry De-nationalization

Discussion of iron and steel de-nationalization has been continued in committee for a further two days. Mrs. White, the Labour Member for East Flint, moved an amendment intended to ensure that before approval was given to particular reorganization proposals the new Supervisory Board would consider their effect upon employment in the areas concerned. She argued that if the Government was not prepared to accept the amendment it would be yet another proof of the Opposition contention that they were not interested in retaining powers necessary to maintain planned full employment. But Mr. Aubrey Jones, who sits as a Conservative for Hall Green, thought that the phrase "full employment" was much too hazy to incorporate in a statute as a directive to a public authority. Full employment was capable of so many definitions. To this Mr. Mitchison jocularly retorted that an elephant was equally difficult to define, but it remained comparatively easy to recognize!

The Parliamentary Secretary (Mr. Low) asserted that full employment was the Government's aim without any qualification whatsoever and the main objection to this Opposition amendment, as he saw it, was that it would not, in fact, help full employment, and indeed might even hinder it. The best contribution the new Supervisory Steel Board could make to full employment would be to encourage the industry to produce efficiently at competitive prices. In any case, both the Board and the steel companies would always assist in finding alternative work for men made redundant by technical advances. Although Mr. Strauss described the Government's scorn of the amendment as "monstrous," it was defeated on a division by a comfortable majority.

Supervisory Board's Powers

Clause 4 of the Iron and Steel Bill was of special interest and resulted in a number of Opposition amendments. It is the clause containing the positive powers possessed by the Supervisory Board. These positive powers in the Bill—as drafted—are first the right of the Minister to be consulted through the Board on the development plans of the industry, and second his reserve powers to do the job himself if the industry will not act. The Opposition amendments to the clause bore a family resemblance to each other in the sense that they sought always to extend the positive powers of the Board in one direction or another. Mr. Sandys, although prepared to listen, is obviously not prepared to accept changes in his legislation which will carry the new authority back very much to the position of the present Steel Corporation.

Hence, on his advice, the Committee rejected nearly everything proposed by the Labour side in connection with Clause 4. For instance, he could not recommend an amendment, on the face of it quite reasonable, to give the Minister the opportunity to take over, if necessary, production facilities not being closed down altogether—that power is in the Bill already—but being inefficiently and uneconomically run. That to Mr. Sandys was obviously to open a door that de-nationalization is supposed to close.

But all-party pressure did result in the Minister handsomely taking under his wing an amendment moved by Mr. Albu which would have the effect of giving power to the Board to engage in the production of raw materials overseas. Mr. Sandys, in accepting this amendment for re-drafting, said that he had been hesitating previously about asking Parliament to approve the principle of more overseas development by the State after some recent unfortunate experiences, which in delicacy he would not name, but his hesitations had now been dispelled by the opinions expressed. He felt that there were no differences on the principle involved. If Government assistance was needed for overseas development, of vital concern to British iron and steel, then it would be readily granted.

Mr. Strauss, in thanking the Minister for his consideration, could not resist pointing out that all the Opposition amendments by nature, apparently, were reasonable and deserved the support of intelligent people. To him it was sad to think that it was only now and again that the other side of the Committee were prepared to be intelligent!

Rate Apportionment

An interesting point concerning electricity supply came out in an Adjournment debate opened by Sir Harold Roper (North Cornwall). He contended that the South Western Electricity Board had been unfairly treated in the new apportionment between Area Boards of the annual payment in lieu of rates. Because of the change from a revenue to a capital basis the South Western Board's share had gone up to 22 per cent. This was milking the Board of funds that might otherwise be available for rural electrification.

The Parliamentary Secretary (Mr. Joynson Hicks) said the new system had been devised by independent advisers of great expert knowledge; the South Western Board had protested, it was true, but the industry as a whole had accepted the basis as fair.

Generous Italian Offer

AN offer of hostel accommodation in Italy for 50 boys from the flooded areas has been received by the British Electricity Authority from Signor Piero Ferrerio, chairman of the Italian National Association of Electricity Supply Undertakings (Associazione Nazionale Imprese Distributrici di Energia Elettrica). Lord Citrine has expressed his warm thanks to Signor Ferrerio for his generous offer which has been passed on to the appropriate authorities.

PARLIAMENTARY NEWS

From Our Special Reporter

IN the House of Commons last week the Secretary of State for Scotland (Mr. Stuart) told Mr. Nabarro that he was informed by the North of Scotland Hydro-Electric Board that the expected load factor of the hydro-electric works embodied in the Breadalbane Project would be approximately 40 per cent, and that the expected saving in coal at a conversion figure of 1·31 lb./kWh generated would be about 180,000 tons annually.

The estimated capital cost per megawatt to be installed was about £170,000, or, if the cost of transmitting the power to the Board's grid was added, about £180,000.

The Board hoped to start construction of the scheme this year, and to produce electricity from it in about four years' time. The scheme should be substantially completed in from five to seven years. The Board estimated that the scheme would require 120,000 tons of cement, 12,000 tons of steel and 800 standards of timber. The use of bricks and cast-iron would be negligible.

China's Requirements

Mr. Rankin asked the President of the Board of Trade what types of machinery were included in the list which the China National Import-Export Board intended to purchase in this country and which was submitted to the Board of Trade on 2nd October, 1952.

Mr. Henry Strauss said that among the main items in the list submitted were pumps, air compressors, engineers' tools, generating sets, diesel engines, electrodes for arc furnaces, sand blast sets with compressors, etc., mine hoist machines, electric tube welding machines, electric deep hole drills, electric coal drills, an electric dynamometer, a mercury rectifier, magnetic separators, various items of electric power station equipment, relays of various types, refrigerators, spares for 11 MW turbines and insulating material.

Storage Space Heating

Mr. Philips Price asked the Minister of Fuel and Power whether, in view of the satisfactory development of devices for storing electricity for space-heating purposes without affecting the demand for electricity at peak periods, he would give a general direction to the British Electricity Authority to arrange for the revision of tariffs to encourage the greater use of such devices.

Mr. Geoffrey Lloyd said that there was no occasion for a general direction, but he was discussing with the B.E.A. whether alterations in general tariff policy could give further encouragement to off-peak consumption.

Private Generating Plant

Mr. Nabarro asked the Minister of Fuel and Power whether he would state the aggregate installed capacity of privately owned generators, and what steps were being taken to encourage parallel working.

Mr. Geoffrey Lloyd said that the figure was not available. The B.E.A., the Federation of British Industries and the National Union of Manufacturers had set up a joint committee to consider the technical requirements.

Mr. Manuel said that where there were independent generators in the North of Scotland there was control of price to the consumers, in the same way as prices were controlled and agreed on by the Hydro-Electric Board providing electricity to the crofting areas and Scottish townships.

Mr. Lloyd said he would consider that.

Sir Herbert Williams asked if it was not a fact that independent generating plants were used by people to supply themselves, and that therefore the price factor did not arise.

Electricity Pensions

Answering Mr. Albert Evans, Mr. Geoffrey Lloyd said that he had carefully considered the position of those pensioners from the electricity industry who were formerly employed by local authorities and he would be prepared to agree to amendments to their pension schemes so as to give them benefits comparable to those given under the Pensions (Increase) Act, 1952. When the scheme was made it would apply retrospectively to 1st October, the date when the Pensions (Increase) Act came into operation.

Replying to Sir Arnold Gridley, Mr. Lloyd said that his answer applied only to those who could have received benefits under the Pensions (Increase) Act.

River Derwent Pollution

IT is reported that a sum of £5,000 has been paid out of Court to the Pride of Derby and Derbyshire Angling Association and Lord Harrington, the plaintiffs in the recent action relating to the pollution of the River Derwent. Half of the amount was paid by British Celanese, Ltd., while payment of the other half was shared by the other defendants, the British Electricity Authority and Derby Corporation.

SOUTH AFRICAN NOTES

Substation Supervisory Control

AT Oakdale, near Cape Town, the South African Electricity Supply Commission has built an outdoor substation where the line transmission voltage is stepped up from 33 kV to the new level of 66 kV necessitated by expansion of the smaller country towns, increased railway electrification, etc. To control the switchgear at the substation a supervisory system has been installed by the General Electric Co., Ltd. The control desk at the Salt River power station carries a mimic diagram of the supply system at Oakdale, control of the various switches being by the use of a large-type discrepancy key, and the indication of the isolators by a small-type discrepancy key. At Oakdale are the substation units together with an indicating mimic diagram of the system, the latter providing indication only of the state of switches and isolators at the substation. The personnel at Oakdale have normally nothing to do with switching except for maintenance.

The equipment supplied is of the G.E.C. multi-group interlocked pulsing step-by-step system and is at present equipped for the control and indication of 19 pneumatically operated oil circuit breakers and the back-indication of 83 isolators and various alarms. The ultimate capacity of the equipment is 31 control-and-indications and 129 back-indications. The indications at Oakdale are provided by red and green lamps. As the pilot cables linking the power station and the substation were laid near some of the main power cables, both the pilot pairs (one of which is used for telephony) are isolated at each end by line transformers specially designed to withstand high voltages.

Increase in Imports

Imports of electrical goods into the Union of South Africa during the nine months ended September last showed an increase of approximately 15 per cent in value on the corresponding period of the previous year. The only decreases were in batteries and lamp bulbs and these were quite small. The accompanying table compares the chief items.

Class of Goods	9 mths. Jan.-Sept.	
	1951 £(000)	1952 £(000)
Batteries and parts	523	513
Dynamos and generators ..	862	908
Motors	1,479	1,676
Transformers	977	1,075
Cable and wire (rubber insulated)	427	579
Cable and wire (other)	800	1,127
Electric stoves and parts ..	262	288
Lamp bulbs	367	346
Radio apparatus and accessories	1,183	1,498

Exports of electric cable and wire during January–September, 1952, were valued at £1,015,000 compared with £926,000 during the corresponding period of 1951, and of machinery, not agricultural, £4,387,000 (£3,715,000).

The Board of Trade and Industries, in a report on the electrical manufacturing industry of the Union, states that before 1940 only twenty-nine local firms were making electrical goods, while by the end of 1950 it found this total had increased to 140, due in large part to the fact that during the war the demand for electrical goods could not be met by imports and such needs had to be made in the country. Further stimulus to such development was provided by the imposition of import control in 1948, and in the five years ended 31st December, 1950, no less than seventy-eight firms began manufacturing electrical goods in the Union.

AUSTRALIAN INDUSTRY

THE book of reference entitled "The Structure and Capacity of Australian Manufacturing Industries," referred to in our issue of 28th November, 1952 (p. 1184), is now available. It has been prepared by the Division of Industrial Development of the Department of National Development and therefore is an Australian Government publication which provides answers from authoritative sources to almost any question that may be asked about secondary industry and development in that country.

The 527 foolscap size pages are divided into seventeen chapters and four appendices with a 35 page three-column index. Chapter I is concerned with fuels, lubricants, light and power, while Chapter XI deals with electrical and electronic products. The book is priced at £3 and it may be ordered through any booksellers or from Angus & Robertson, Ltd., 48, Bloomsbury Street, London, W.C.1.

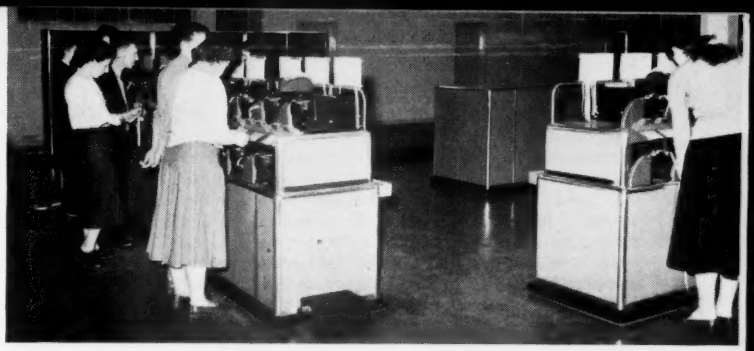
CONTRACT PRICE FORMULÆ

THE British Electrical and Allied Manufacturers' Association has issued the figures for its contract price adjustment formulæ. In each case the rate of pay for adult male labour at 14th February is deemed to be 141s 6d. The "cost of material" figures are as follows:—

For electrical machinery and equipment: the Board of Trade index figure published on 14th February is 162·2.

For turbo-generating and allied plant: materials used in mechanical engineering industries, 148·6; blast furnaces and iron and steel smelting and rolling (40 and 41), 142·3; price of ⅜in o/d 18 s.w.g. brass condenser tubes (*Metal Bulletin*, 13th February), 3s 10¾d.

Outstanding contracts covered by the Board of Trade intermediate products index: The index figure for intermediate products (14th February) is 359·7.



Part of the terminal centre of the new Civil Aviation Communications Centre at Croydon

One of the racks in the Post Office equipment room for generating operating frequencies for the teleprinter circuits is shown below

Civil Aviation Communications

New Ministry of Civil Aviation Centre at Croydon

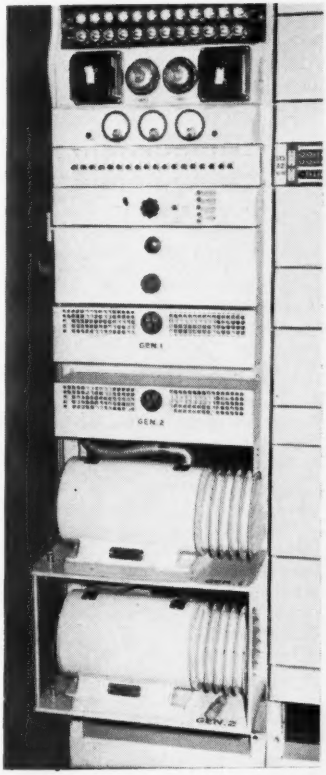
SWIFT, accurate and economical handling of operational messages between airports, air traffic control centres and operating companies is a prime requirement and is one of the main activities of the Ministry of Civil Aviation.

An aeronautical fixed telecommunications network of teleprinter, radio-teletype and hand-operated morse circuits radiating to all parts of the world has been set up within and between the member states of the International Civil Aviation Organization (I.C.A.O.), the new Croydon communications centre being the heart of the United Kingdom's part of the network. It replaces the former signals centre at London Airport and marks the beginning of a major rationalization of the aeronautical fixed telecommunications network which has grown up piecemeal since the war ended.

The new centre is housed in one of the Croydon Airport buildings. This building has been entirely reconstructed internally and its radically new layout has been designed from experience to contain automatic equipment arranged in such a way as to "streamline" the functions of the individual operator. The greatly increased speed of the latest types of aircraft makes it more important than ever before to pass messages (e.g., reporting their time of arrival) well ahead of the aircraft themselves.

Initially about 1,000 transactions will be handled in the peak hour over some 30 circuits, but the centre is so designed as to deal ultimately with 3,000 transactions an hour at peak over more than 60 circuits. Croydon Airport has been chosen as the most suitable site in the London area as a point easily connected with G.P.O. circuits and at the same time near the major users of the network.

The Ministry of Civil Aviation is indebted to the



Engineering Department of the G.P.O. which has been responsible for installing the equipment at Croydon and providing circuits to exacting requirements because of the need to reduce transmission time, obviate the retransmission of messages, reduce the number of subsidiary centres for circuit economy and simplify individual operators' functions for minimizing the training commitment and risk of error.

At the new centre the outgoing automatic transmitters are mounted in consoles and, like the re-perforators, are closely spaced so that many can be fed by a single operator during off-peak hours. The sending operators and their equipment are on the other side of the "washboards," ensuring that the space in which the "circulator" must move is reserved solely for him. ("Washboards" are small metal plates in which slits are cut of such a size that they will grip the partially-perforated tapes fed into them.) The consoles are arranged in a U-shaped formation to allow for subsequent expansion. Their design and manufacture was undertaken by the Ministry's installation, test and repair unit.

Other facilities provided are for priority control, for the automatic sending of a circuit designator and sequential circuit-message number at the commencement of every message and for fault control. Full stand-by power arrangements, automatic clocks and other ancillaries are provided and the G.P.O. has undertaken the maintenance of all the telecommunications equipment. The United Kingdom is thus well to the fore in the move to greater speed and efficiency in message handling while the Ministry of Civil Aviation will possess the basis of a network which can confidently be expected to satisfy the needs of commercial aviation for some years.

Further advancement can come only by increasing the degree of mechanization of the system. In some ways this can be done as soon as certain items of equipment become available in quantity. Beyond this, further steps could be taken providing international agreement could be obtained to the adoption of a world-wide procedure, chosen primarily for its suitability for tape-relay methods. This, however, continues to be a limiting factor.

CORRESPONDENCE

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for the opinions expressed by correspondents.

Circuit Calculations

WITH reference to the article by Mr. J. E. Macfarlane in your issue of 13th February, it may be observed that the transformation formulæ (6) relating to the conversion from star to mesh may be derived by the following artifice (Blondel, "Les Courants Alternatifs," 1933, p. 356: "Electric Circuits" (M.I.T., 1940), p. 148).

Equivalence of the star and mesh arrangements implies the identity of corresponding line currents. This identity will be unaffected if equal impedances (resistances in the present case) are connected between corresponding pairs of terminals in the two cases: in particular these supplementary resistances may each be equal to nothing. Thus, suppose terminals A and B are connected together in Fig. 2 (*a*) and 2 (*b*). On equating the expressions for the conductance between the common terminal A, B and the third terminal C one obtains:—

$$G_1 + G_2 = \frac{(G_a + G_b)\, G_c}{G_a + G_b + G_c}$$

By transferring the short-circuit successively to B, C and C, A two further equations similar to the above may be written down. These equations will be seen to be of the same form as those relating to the conversion from mesh to star in terms of resistances and hence the calculation of G_1, G_2 and G_3 is similar to that of R_1, R_2 and R_3.

University of Nottingham. S. A. SWANN.

Electricity to Replace Gas

Work is to begin this year on conversion from gas to electricity in 175 houses at Cupar. The cost, in the region of £5,000, will be met by tenants at the rate of 2s weekly for about six years.

Coronation Showroom Displays

Two E.D.A. Designs

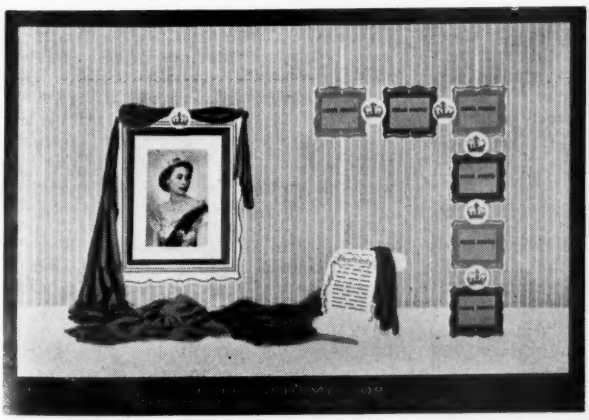
TWO simple but attractive and dignified Coronation displays, for use in the windows of electricity showrooms, have been prepared by the Exhibition Department of the British Electrical Development Association. The first is intended essentially for the more important showrooms but would look imposing in any situation, while the second is intended for general use and would suit quite small windows. Both displays provide for maintaining interest by the inclusion of news photographs of the Coronation preparations, ceremony and decorations.

The first display consists of a centre panel 5ft wide containing a 20in by 30in photograph of the Queen alongside a goodwill message, the whole mounted on hardboard and supported on steel rods; five blue banners (or more for larger windows) each 6ft 3in high, of glazed linen printed with the monogram of the particular Electricity Board using the display, and mounted on timber poles with finial and base finished in gilt metallic paint; and four (or more) plaques 18in in diameter of stout plywood, to accommodate news photographs, which it is intended should form the lower part of this display.

The second display consists of a deep frame 40 by 30in of 2 mm pulpboard printed by a four-colour silk screen process, with silk screen half-tone portrait of the Queen; a goodwill message on a scroll 20 by 16in constructed in 8-sheet pasteboard printed by a four-colour silk screen process—this and the previous item could be connected by coloured drapes of crepe paper, or fabric such as dyed muslin, casement cloth or velvet; and five frames 12in square for accommodating news photographs, having slots and tie pieces so as to join up in any direction.

In order to sustain interest in these Coronation displays, E.D.A. is arranging for the dispatch to the various electricity showrooms each week, of "last-minute" news photographs to replace the current ones being displayed.

One of the two E.D.A. Coronation window displays



Electricity Tariff Handbook

AN "Electricity Tariff Handbook" has been compiled by the *Electrical Review* with the advice and assistance of Mr. V. A. H. Clements, M.I.E.E., assistant commercial manager, B.E.A., and will be published on February 25th next by Electrical Review Publications, Ltd., and distributed by Iliffe & Sons, Ltd., Dorset House, Stamford Street, London, S.E.1, price 7s 6d (postage 3d). This reference book (64 pages) gives full details of the standard tariffs in operation in England, Scotland and Wales by the various Electricity Boards. The classes of tariff shown are: Domestic, commercial (block type and maximum demand type), industrial (block and m.d.), farm, and miscellaneous. For ease of reference, a tabular summary of each class is provided. The B.E.A. bulk supply tariff is also shown and other information given includes names and addresses of chief commercial officers of the Area Boards, definitions of the official terms and classifications used, and tables showing national electricity sales and revenue for 1951-52. All the information given in the book is authoritative and completely up-to-date.

This is the first time such information has been collected in a handy form; it should be invaluable to all concerned with sales of electricity and also to large numbers of consumers.

ELECTRONIC SPEED CONTROL

Applications to D.C. Motors

USES in industry of electronic methods of speed control were discussed in a lecture delivered on Tuesday last by Mr. J. C. Rankin (British Thomson-Houston Co., Ltd.) to the Association of Supervising Electrical Engineers. In general, he said, d.c. motors were employed, the control being by variation of armature volts or field excitation or both. An electronically controlled a.c./d.c. power convertor kept the speed within a given percentage of its required value, regardless of load, voltage or temperature fluctuations.

Type of Valve Employed

The types of valves ranged from small triodes or pentodes, as used in radio sets, to large gasfilled valves such as thyratrons (up to 12·5 A) and ignitrons (up to 200 A). Saturable reactors with two windings, a.c. and d.c. (the impedance of the one depending on the current through the other) and magnetic amplifiers now often replaced hard valves for control circuits. Triode and pentode valves, amplifying small speed and current signals to a magnitude sufficient to control the main rectifiers, were similar to diodes with the addition of one or more grids between anode and cathode to control the current through the valve.

The thyratron was a three or four electrode valve having a heated cathode, control grid and anode and sometimes a screen grid. Its grid characteristics differed from that of the hard (vacuum) valve in which the anode current was closely related to the grid voltage. Conduction from thyratron anode to cathode took place only while the grid voltage exceeded a critical value, but continued, irrespective of grid voltage, until the anode supply was interrupted or became negative to the cathode as with a.c.; thus by controlling the initiation of conduction the mean current or voltage output of a rectifier circuit could be accurately regulated.

The ignitron had main and auxiliary anodes, a mercury pool cathode and an ignition electrode or ignitor dipping into the mercury. A current pulse through the ignitor formed a hot spot at the meniscus between the ignitor and pool, setting up ionization and forming an arc to the auxiliary anode (supplied from an a.c. source). The main arc then started and was maintained until the anode became negative to the cathode in each cycle. The conduction period, and thus the output of the rectifier, was determined by controlling the instant of ignition of the ignitor pulse.

Motor control equipment was divisible into three sections: the rectifier or motor generator controlling the flow of power to the armature and to the field; an electronic or magnetic amplifier regulating the action of the power controller; and a means of measuring the correction required.

Reversal of Rotation

Further developments included coping with frequent reversals of direction of rotation. One for f.h.p. motors required a separate series field for each direction, each fed from an electronically controlled rectifier. For larger horse-powers a single armature rectifier and two field rectifiers were employed, the first being current-controlled during reversal of field supply and standstill, while the running speed was controlled by tachogenerator feed-back. The speed of an a.c. induction motor could be controlled by means of a phase unbalance produced by connecting two pairs of ignitrons or thyratrons back-to-back in two lines.

For complex variable-speed drives, electronic methods provided a close stepless speed control over a wide range; accurate regulation at any preset speed; inching and crawling speeds without an additional motor; a compact device placeable near the operator; absence of vibration and moving parts; a control panel that could be built into a machine tool; and absence of change-speed gear box for machine tools. Examples of industries in which electronic control offered striking advantages were textiles, paper or cellulose film manufacture, the ring-spinning of cotton, newspaper printing and wind tunnel or fan drives.

RECENT INTRODUCTIONS

Notes on New Electrical and Allied Products

Coronation Lighting Set

THE GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, London, W.C.2, has produced a Coronation decorative lighting set consisting of twelve "Osram" 20 V, 3 W bulbs coloured red and white and blue and white and wired for series burning. It is supplied complete (including one spare bulb) with holders, flex and adaptor for operation on 200–260 V mains. The price is 26s 3d including purchase tax in the United Kingdom.

A.C. Voltage Stabilizers

The latest a.c. automatic voltage stabilizer (Type BAVR) to be made available by CLAUDE LYONS, LTD., 76, Old Hall Street, Liverpool, 3, has a stability of ± 0·15 per cent irrespective of load or frequency variations and is available with ratings of 200 VA, 500 VA or 1,000 VA; the output voltage is constant at 235 V with an input of 205 V to 250 V. The control device itself is a magnetic amplifier, the inductance of which varies with the d.c. passed through the control coils. Stabilization is achieved by monitoring the output side and regulating automatically the d.c. component so as to adjust the a.c. output voltage and keep it constant within precise limits.

Temperature Indicators

Temperature indicating powders with the trade name "Thermocolor" are now available from ALLIED COLLOIDS (BRADFORD), LTD., 11, Great St. Thomas Apostle, Queen Street, London, E.C.4. These products are applied in the form of a paint with industrial methylated spirits, and give accurate indication of the thermal zones under observation. Other chemical temperature indicating products are the "Thermochrom" crayons which are available in boxes of twelve or fifteen, and work on a similar principle to "Thermocolor" powders.

Indicating Control Units

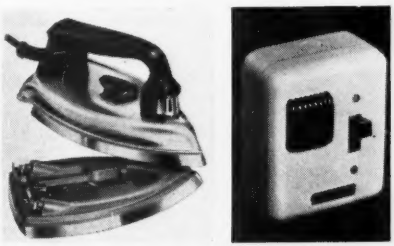
Further additions to their range of switch units are announced by ARROW ELECTRIC SWITCHES, LTD., Hanger Lane, Ealing, London, W.5. These are based on the design of the original units which have been modified to take standard lamps and are fitted with large square type lenses.

The tumbler pattern is rated up to 30 A at 250 V a.c./d.c. and is provided with a red bullseye for the standard 15 W pygmy sign lamp or alternatively a plain lens where small wattage neon lamps are used.

Rotary units are also available incorporating a number of improvements. They are rated up to 20 A at 250 V a.c./d.c.

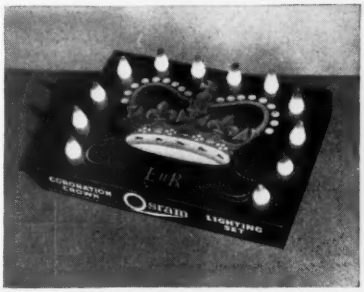
Lightweight Electric Iron

The lightweight "Sylph" electric iron which is now being offered by PREMIER ELECTRIC HEATERS, LTD., Keeley Street, Birmingham, 9, weighs only 3¼ lb. The "Sylph" iron incorporates the "Premicoil" element, a special wire coil element, fully insulated, enclosed in a metal tube and cast into the light alloy base. Thermostatically controlled, the iron's maximum consumption is 1 kW and it is available for two



Left: **Premier "Sylph" iron.** *Right:* **"Arrow" tumbler type indicating control unit**

"Osram" Coronation decorative lighting set



voltage ranges, 200/220 or 230/250, a.c. only. The all-chromium body is fitted with a well-formed black " Bakelite " handle, the front of which houses a signal lamp to indicate when the iron is switched on. Each iron is supplied with 3 yd of three-core flexible cable and is guaranteed for twelve months. The price is 59s 6d.

Nylon Bearings

The Witton Moulded Insulation Works of the G.E.C. is now making small nylon bearing bushes for the wringers of washing machines which were normally made of metal. Preliminary reports from Wilkins & Mitchell, Ltd., the makers of the washing machine, indicate that the change has been satisfactory. The change was made because lubrication by oil, which is necessary in a metal bearing, is not the ideal method on a washing machine since the detergents used in washing soon disperse the oil. Nylon on the other hand is lubricated by water.

The bearings are injection moulded in a 10-ton hydraulic press with an injection pressure of 7 tons/sq in, the moulding cycle time being 0·75 min. The internal diameter of the bearing is 0·5in.

STREET LIGHTING NOTES

A LARGE fluorescent street lighting contract has been completed by Siemens Electric Lamps & Supplies, Ltd., at Newry, Co. Down, covering 15 miles of roadway in the relighting of which 90 Class A and 493 Class B " Sieray " fluorescent units have been used. The Class A lanterns are constructed with a special end box whereby the control gear is practically over the centre line of the column, all the castings being of aluminium alloy 2L33. The reflector system incorporates specially treated aluminium alloy reflectors, the whole being totally enclosed in a clear " Perspex " bowl. The lantern and control gear are rendered completely water tight by a special compressive cable gland. The Class B lanterns are a revised version of the " Wilton Sieray Minor," manufactured for side-entry fixing, and utilize a lightly diffused " Perspex " bowl to eliminate glare. The lanterns and instant start control gear were manufactured at the Halifax works of Alfred Graham & Co., Ltd., part of the Siemens organization. The concrete poles were supplied by Concrete Utilities, Ltd. The erection of the poles was facilitated by spade roots which made it easier to avoid obstructions. Installation was carried out by Mr. P. J. Murray, of Newry, in conjunction with the Electricity Board for Northern Ireland and Siemens street lighting engineers.

CHATTERIS (Cambs.) U.D.C. is to proceed with a scheme for lighting the main part of the town by electricity.

LEWISHAM Works and Highways Committee recommends the installation of main road lighting in Ravensbourne Park, Manwood Road, Crofton Park Road and Marnock Road at a total cost not exceeding £3,500.

DONCASTER Town Council is preparing a scheme for the improved lighting of the Balby district.

Street lighting in Dudley Road, GRANTHAM, is to be converted to electricity at an estimated cost of £400.

WHITEHEAD (Co. Antrim) Council has decided to install a new sodium lighting system in the town at a cost of £4,375.

SITTINGBOURNE and MILTON (Kent) U.D.C. has asked for a detailed report on proposals for the provision of sixty-four street lamps, to cost approximately £4,125. A report placed before the Council suggested lighting in a number of streets at a cost of £6,040, but after members had discussed the matter it was decided to ask for details of the first three sections of the scheme.

TYNEMOUTH Town Council is being recommended to include in its estimates £2,986 for improving the street lighting in Wallsend Road and Queen Alexandra Road West.

A section of the new fluorescent lighting in Newry, Co. Down

Commerce and Industry

Fewer Domestic Appliances Manufactured

Plastics Productivity Team's Report

PRODUCTION of both electrical and gas cooking and water-heating equipment declined during 1952. The January "Digest of Statistics" shows that the monthly average production of gas cookers during the year was 60,200 compared with 71,000 in 1951; the corresponding figures for electric cookers were 14,700 and 26,500. The average monthly output of gas wash boilers fell from 36,900 in 1951 to 30,500 last year and that of electric wash boilers from 11,600 to 10,700. Gas water heater production declined from a monthly average of 18,000 to 11,400. The output of electric immersion heaters fell from a monthly average of 18,900 to 15,000 and that of electric storage heaters (up to 30 gallons) from 5,900 to 4,600. Decreases also occurred in the production of meters: gas from 116,900 a month to 115,300 and electric from 138,000 to 121,400.

The figures relating to other domestic appliances are not available for the full year, but the downward tendency is also apparent in the production of electric washing machines, irons, kettles and vacuum cleaners.

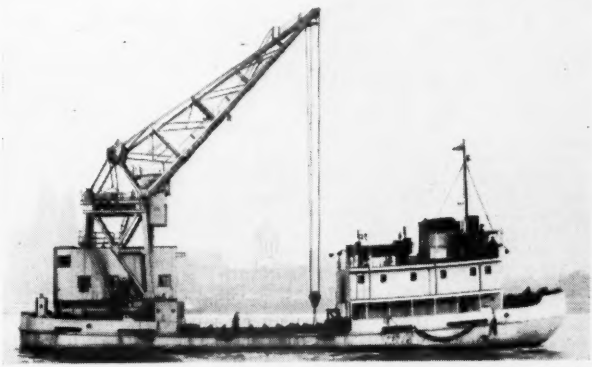
A Large Crane

A floating crane manufactured by Cowans, Sheldon & Co. (hull by Lobnitz & Co.) for the Mersey Docks and Harbour Board is of 20 tons capacity and is propelled by twin screws driven by reciprocating steam engines at up to 10 knots. Ward-Leonard electrical equipment by Laurence, Scott & Electromotors, Ltd., ensures full-load lifting speeds of 25 ft/min rising to 50 ft/min with a light hook, the minimum full-load lowering speed not exceeding 2·5 ft/min. Lowering speeds of up to 45 ft/min are controlled by regenerative braking and dead loading in three stages. A master controller of twelve steps is provided, electrically contrived to ensure smooth and safe switching however fast the control handle may be operated.

The hoist and derrick motors are interchangeable, one or the other being connected through a change-over switch to the W-L generator. The slew and shifting-ballast motors operate on the 220 V constant voltage supply system.

Details of the machines are: one Ward-Leonard d.c./d.c. motor generator of 58·5 kW; two (one spare) 20 h.p. at 700 r.p.m. hoist and derrick motors; two (one spare) 25 h.p. at 700 r.p.m. slew and shifting-ballast motors, while in addition to the main control panel there is an automatic contactor starter and two two-step starters.

Generally similar equipment is in hand for a 100 ton floating crane for the same customer.



Steam propelled floating crane with Ward-Leonard control for the Mersey Docks and Harbour Board

Scottish Exhibitions

The North of Scotland Hydro-Electric Board is holding two exhibitions in Perth next month. In the City and Lesser Halls from 10th to 14th March over forty well-known electrical manufacturers will display domestic and industrial appliances. The agricultural community will be catered for in the Drill Hall, Tay Street, Perth, on 13th, 14th and 16th March, where some thirty exhibitors will have on show

equipment suitable for installation on the farm. The exhibitions will display some 3,000 items. The highlight of the exhibition in the City and Lesser Hall will be " Bill and Peggy's Home," a house which will actually be lived in by two people. It will be an all-electric house, and " Bill " and " Peggy " will demonstrate the equipment. On the stage will be a 60ft model of Pitlochry dam and power station complete with fish pass. Over 200 gallons of water will flow over the spillways of the dam each minute to give added realism. This display piece will be laid out in a natural setting. Admission to the entire exhibition will be free.

Among equipment at the agricultural exhibition will be various machines, straight from farms, designed originally for manual or engine operation and now successfully converted for running by electricity.

Plastics Productivity

The latest report published by the British Productivity Council (formerly the Anglo-American Council on Productivity) is that of a team from the British plastics moulding industry which visited the United States last year.

In the first part of the report attention is paid to the " American way of life " as it is related to the remuneration of industrial workers, the conclusion being drawn that American workers give better value for their pay because they themselves get better value for their expenditure. Working conditions appear to be good and three-shift operation is general in the moulding industry.

After a section on estimating, costing, planning and sales the report turns to the technical side and deals at some length with machines and processes in thermoplastic and thermosetting moulding. A great many recommendations are made in connection with working conditions, organization and improvement of technique. Copies of the report are obtainable at 5s 6d from the Council at 21, Tothill Street, London, S.W.1.

Electricity Administration

The National Joint Advisory Council (Electricity Supply Industry) has informed the London District J.A.C. that it cannot " recognize " the British Institute of Electricity Administration. Among the reasons given for this decision is the fact that the Institute, because of its small membership, cannot be regarded as representative. It is also said that there are insufficient grounds to justify the claim of the Institute that there is a requirement for a qualification unique to the electricity supply industry in the administration field.

Rubber Production and Consumption

According to statistics provided by the Secretariat of the Rubber Study Group the production of natural rubber in 1952 amounted to 1,762,500 long tons and the consumption 1,447,500 tons. Stocks at the end of the year stood at 782,500 tons—30,000 tons less than at the close of 1951. Synthetic rubber production totalled 878,500 tons and consumption 885,000 tons. The year-end stocks amounted to 140,000 tons, a decrease of 2,500 tons.

Iron and Steel Prices

The Minister of Supply has made two Orders effecting minor changes in iron and steel prices. The Iron and Steel Scrap (Amendment No. 1) Order, 1953 (S.I. 1953 No. 170), increases the controlled maximum delivered prices of iron and steel scrap so as to allow for the recent rise in transport charges. The increases in scrap prices range from 11d to 1s 11d per ton. The Iron and Steel Prices Order, 1953 (S.I. 1953 No. 169), increases the maximum prices of a small number of iron and steel products which were unduly depressed in relation to the general price level. The Order also permits some increase in the extra charges which may be made for the delivery of certain types of steel to places distant from the steelworks. The products principally affected by the Order are acid steel billets, tube steel, railway axles and certain types of pig iron. The prices of these products will be increased by between $\frac{3}{4}$ per cent and 8 per cent.

Prices of Materials

In the accompanying table we give the prices of the more important materials used in the electrical industry. The figures are those quoted on Monday last.

ALUMINIUM Ingots	ton £166 0s 0d
COPPER, H.C. Electro	ton £285 0s 0d
Fire Refined 99·70 per cent ..	ton £282 10s 0d
Fire Refined 99·50 per cent ..	ton £274 0s 0d
COPPER Tubes	lb 2s 8$\frac{3}{4}$d
Sheet	ton £338 10s 0d
H.C. wire and strip	ton £317 15s 0d
LEAD, English	ton £93 5s 0d
Foreign	ton £92 0s 0d
MERCURY	flask £70 10s 0d
TIN	ton £951 0s 0d
ZINC, G.O.B. Foreign	ton £81 5s 0d
Electrolytic	ton £85 0s 0d
BRASS Tubes	lb 2s 2d
Sheet	ton £267 15s 0d
Wire	lb 2s 7$\frac{1}{4}$d
PHOSPHOR BRONZE	
Wire	lb 4s 1$\frac{1}{2}$d
RUBBER, No. 1 R.S.S. spot ..	lb 22$\frac{1}{2}$d–23d

Conveyor Film

Interested readers can obtain, on free loan, a film recently produced by the Mechanical Handling Engineers' Association under the title of " Conveyors as your Servants." The film was devised to serve as a supplement to the documentary film " Mechanical Handling " released in 1948, and it indicates some of the extensive possibilities of application of mechanical means for the movement of all types of materials and goods in all industrial processes. " Conveyors as your Servants " is a 16 mm

film, in colour, running for 36 minutes, with a sound commentary, and applications for prints on loan should be made to the Association at 94-98, Petty France, London, S.W.1.

Falk's Southampton Depot

On 10th February the new branch premises of Falk, Stadelmann & Co., Ltd., at 10, Commercial Road, Southampton, were formally inaugurated by Mr. A. E. Marsh-Hunn, president of the Southampton Chamber of Commerce. The premises were acquired about two years ago, and war damage has been repaired and the building redecorated. It comprises a showroom and trade counter with a warehouse at the rear. The equipment shown and in stock includes a wide selection of lighting fittings for industrial, commercial and domestic use, and the company's range of domestic electrical apparatus. The branch is intended to serve part of the south coast area, most of Hampshire and the Isle of Wight. The manager of the new branch is Mr. J. Pitfield.

In performing the opening ceremony, Mr. Marsh-Hunn said that the opening of the Southampton branch showed considerable foresight, and the facilities offered would be of help in the long-term task of the rehabilitation of Southampton. Mr. Cecil Falk (sales director) expressed his thanks to Mr. Marsh-Hunn.

Art Appreciation

A collection of paintings and drawings by well-known artists, covering a wide range of styles and periods, is being displayed at the Horsley Towers Training Establishment of the British Electricity Authority in use for students attending courses of one or two weeks' duration, and the pictures, which will go on show next week, will be used for recreational discussion and talks on art appreciation. The pictures have been lent by the Saville Club, Mr. J. B. Priestley, Mr. D. Cleghorn Thomson, director of welfare, B.E.A., and the artists themselves. In three or four months they will be replaced by a second group of pictures.

A group of Scottish painters in Edinburgh is forming a second collection of pictures for similar use and display in the Authority's other training establishment at Electricity Hall, Buxton.

Banknote Destructor

A destructor for the disposal of old and dirty currency notes and banknotes has been manufactured by the General Electric Co., Ltd. The machine consumes £250,000 in pound notes each day, and approximately 80,000 treasury notes can be charged at one time. Security safeguards are of necessity incorporated in the machine. Officials who wish to inspect the progress of burning look through an armour-plated glass-covered spyhole which projects from the front of the destructor. To prevent the possible extraction of notes by unauthorized

Banknote destructor made by the G.E.C.

persons a double charging door is fitted so that the inner charging platform cannot be opened unless the outer lid is closed, an action which shoots the notes into the combustion chamber. The destructor has a rocking bar hearth, motor driven through worm reduction gears. This hearth movement ensures separation of the bundles of notes and is an effective ash breaker. The disposal of the ash after the notes have been burned can be controlled; the ash drawer of the machine having a special lock.

The body of the unit is refractory lined and, in spite of the intense heat generated by the burning treasury notes, the outer surface of the equipment has a very limited temperature rise even when the unit is working to capacity. Air control is provided both above and below the grate. Total rating of the unit is 6 kW. The igniting elements are under the control of a time switch and hand-operated rotary switch. All control equipment and fuses for all circuits are built into a side panel and indicating lamps are provided for the main switch, the motor and the igniting elements.

Advice for the Farmer

To assist the farmer to make the best and most economical use of electricity the Merseyside and North Wales Electricity Board has produced a 48-page booklet entitled "Electricity for the Farmer," which describes the main agricultural uses of electricity and gives practical information and data concerning the apparatus described. It will be circulated free to all the Board's farming consumers.

The booklet is divided into ten sections ("Lighting," "Dairy," "Horticulture," etc.),

in each of which are illustrations of apparatus and details of the work it will do. Of particular value are the tables which clearly show the type of machine, the power required and the output per kWh. Among the more unusual pieces of apparatus dealt with are the electric foster mother for young pigs, the poultry plucker, soil warming and light irradiation installations, and the single strand cattle fence.

A.S.E.E. Dinner

The annual dinner and reunion of the Association of Supervising Electrical Engineers will be held on 10th April at the Connaught Rooms, Great Queen Street, London, W.C.2.

Making Valves and C.R. Tubes

Last week we saw the preview of a 30-minute technical film entitled "It's a Good Sign" which has been made by National Screen Service, Ltd., in collaboration with Mullard, Ltd., to help members of the radio trade to understand more fully some of the complex problems involved in the manufacture of valves and television picture tubes. A special adaptation of the film is in course of preparation for showing in schools and technical colleges.

Argentine Proposals

Under the Argentine Government's second five-year plan (1953–57) a total expenditure of 33,500 million pesos (probably about £860 million) is envisaged. Included in the total are the items "electric power," 2,500 million pesos, and communications, 2,215 million.

Trade Announcements

Mr. R. H. Hughes, Swansea, has relinquished his agency for South Wales for **Truvox, Ltd.**, because of ill health. The agency has been taken over by Southern Electrical Agencies, 16, Victoria Road, Penarth, Glam. (telephone, Penarth 372).

The **Tubela Engineering Co., Ltd.**, which has hitherto placed its products through sole distributors, will, as from 25th February, handle distribution itself through normal trade channels.

The address of **Adam & Harvey (Rapid Hammer), Ltd.**, is now Greenwich House, 10-13, Newgate Street, London, E.C.1 (telephone : City 6671).

The **Aberdare Electric Co., Ltd.**, announces that "Thermodare" "Off-Peak" storage space heaters are now free of purchase tax for all non-domestic installations. The company's London office has been moved to 36, Victoria Street, S.W.1 (telephone : Abbey 1060).

The Cardiff office and stockroom of the **Hoffmann Manufacturing Co., Ltd.**, has been moved to 121, Cathedral Road, Cardiff (telephone : Cardiff 30133).

Catalogues and Lists

Multicore Solders, Ltd., Multicore Works, Maylands Avenue, Hemel Hempstead, Herts.—Technical summary M.52 dealing with the many "Multicore" soldering products.

The Telegraph Construction & Maintenance Co., Ltd., Telcon Works, Greenwich, London, S.E.10.—"Telcon Telecommunication Cables"—a 32-page catalogue.

The Stabilag Co., Ltd., 1, Broad Street Buildings, Liverpool Street, London, E.C.2.—Illustrated folder dealing with infra-red plant heating by means of "Stabilag" jackets.

Foster Transformers, Ltd., South Wimbledon, London, S.W.19.—Illustrated brochure of their principal products including transformers, test equipments and voltage regulating equipment (FM.12).

Small Electric Motors, Ltd., Beckenham, Kent.—Illustrated technical leaflet on S.E.M. compound wound d.c. motors (drip-proof type).

Milne & Longbottom, Ltd., Elm Works, Mere Lane, Rochdale, Lancs.—Illustrated display folder showing types of "Elm" switchgear and contactors.

Courtney, Pope (Electrical), Ltd., Amhurst Park Works, Tottenham, London, N.15.—Literature covering a range of Coronation lighting units.

Nettle Accessories, Ltd., Harper Road, Wythenshawe, Manchester.—List announcing reduced prices of the "Nettle" range of 15 A socket outlets and plugs (23).

Walter Logan & Co., Ltd., 26, Downing Court, Brunswick Square, London, W.C.1.—12-page catalogue illustrating a range of all-insulated water- and vapour-proof lampholders for fluorescent lamps and water-proof control gear cases for fluorescent fittings.

Information Department

THE extensive records of our Information Department enable us to reply to most queries, but occasionally we ask our readers' assistance in tracing names and addresses not known to us. We should be glad to have such information regarding the makers of the following:—

"Reliant" electric wash boiler.

General inquiries from readers relating to sources of electrical goods, makers' addresses, etc., are replied to by the Information Department through the post. Inquiries should be accompanied by a stamped addressed envelope.

POWER FARMING

Arguments in Favour of Electrification

THE application of electricity to farming was a topic much in evidence at the third National Power Farming Conference held by the *Power Farmer* at Cheltenham last week. The economic aspect and in particular the use of electricity for grain drying were especially to the fore and promoted a considerable amount of useful discussion among the 800 delegates.

Speaking on "Recent Developments in Grain Drying," Mr. H. T. Horsman, machinery officer in the South West Province of the National Agricultural Advisory Service, said the variety of sizes and types of successful drying plant was very wide and often it was found that an elaborate plant was installed when a small one would do. A number of small farmers had erected small grain pits which fed by elevator into old winnowers, power driven by small geared electric motors.

The cost of such equipment was low—one he knew was only £30. After cleaning in this plant, the grain in hessian sacks was placed in single layers on duckboards. This method was most attractive to the small man but about one year in five saw this system in trouble. A dryer was the answer to many problems.

Fuel	Cost of heater fan unit, including motor	Consumption of fuel per hour	Running cost per hour
Oil ..	£308	1 gal diesel oil	1s 6d
Electricity	£185	48 kWh	4s 6d
Coke ..	£237	16 lb coke	1s 0d

A wide range of dryers now on the market included tray and continuous units, bin dryers and sack dryers. The sack or platform dryer was an excellent development, the standard unit consisting of a platform with forty to forty-eight sack apertures connected to a heater fan unit delivering 5,000 cu ft/min of air heated to 25 deg F above atmosphere. This unit would dry 2 tons of grain in sacks at a rate of approximately 1 per cent moisture extraction per hour. It was a safe, virtually foolproof machine of proved worth, and could be operated by oil, electricity and coke, the comparative costs being as shown in the accompanying table.

The choice of plant would depend on the relative importance of low capital outlay and running costs, convenience, and availability of oil, coke or electricity. These standard units were easily able to deal with 200 tons of grain per season.

A scaled-down version of the electrical model used 13 kW and handled 1 ton of grain at ½ per cent extraction per hour. This cost £84 and was a very useful unit for the really small farmer.

All these units were particularly suitable for installation by the farmer himself. He could erect the forty-hole platform in an existing building at a cost of £80 to £100, buy the unit and install it in a lean-to shed costing £50 or so. This gave a plant costing £300 to £450.

A further development now under construction was based on an American rice dryer. A vertical bin of 2 tons grain had the warmed air admitted from one side by spaced horizontal channels. Grain flow was by gravity in batches, and this looked like being a possible answer to a compact labour-saving unit.

In bin dryers air warmed 10 deg F or so above atmosphere was blown upwards through the grain via a porous floor. A well-proportioned plant should dry 60 to 80 tons of grain ½ per cent every 24 hours. Continuous blowing over a comparatively long period was essential, and the system was particularly suited to electrical application.

Experience showed that a larger number of small bins gave better flexibility than a smaller number of larger bins. Special attention must be given to the air tightness of air ducts, air valves and bin walls, while porous floors must really be porous. A grain cleaner before the bins was a great advantage. Fan capacity should be adequate to blow up to 80 per cent of total tonnage if necessary, and any grain over 20 per cent moisture content needed special

attention. Blowing should be continued long enough to dry all the grain and the grain should be turned after drying.

A six-bin plant of 150 tons costs £170 more than an equivalent non-ventilated unit. A typical electrically heated fan unit would cost £260 installed, giving a total cost of £430 as additional capital cost for drying the 150 tons. Actual running costs of such a plant would be somewhere between 10s and £1 per ton.

One of the heavy cost items with bin storage was the necessary conveying system. When purchased as either mechanical or pneumatic conveyors, costs could exceed £300 for a 150 ton plant. The handyman could save by making his own.

In the discussion which followed this paper Mr. W. S. Stearns, a Canadian who for the past eight years has been farming in Kent, said he was not sure that sack dryers were cheapest in the long run for the small farmer: handling was a big problem. Dr. B. T. Sandor (Scottish Mechanical Light Industries, Ltd.) suggested the use of a heated cyclone in which the air speed was three times that of the grain and in which infra-red heating might be introduced.

Regarding the comparative costs of oil, electrical and coke operation of the sack dryers Mr. Finn-Kelcey (Berkshire) thought that a further £50 should be added to the oil and coke units for housing, bringing the totals respectively to £358 and £287, the cost of the electrical unit remaining at £185. For an average 4 per cent extraction the running cost of an electrical unit would work out at 9s a ton.

Mr. P. I. Tesoriere (Banbury) spoke of air-tight silos and the possibility of storing grain indefinitely in CO_2, and Mr. R. H. Bettison questioned whether the small dryers referred to would cope with really wet grain. Mr. E. C. Claydon (S.E. Electricity Board) pointed out that one of the biggest advantages of electrical dryers was that they could readily be constructed and arranged to meet customers' individual requirements. He thought that a grain cleaner was almost essential and he claimed that the average cost of drying in bins was about 5s rather than £1 a ton. Another speaker doubted whether a farmer could afford to spare a tractor for three months a year to provide power and heat for grain drying. Capt. E. N. Griffiths (Essex) contended that for in-bin drying ventilation must be provided at at least three levels and he drew attention to the troubles experienced through mice and rats damaging the electrical installation.

Replying to points raised, Mr. Horsman said that the cost of grain drying ranged from 5s to £1 a ton for the various methods. The small sack dryer was proving quite satisfactory in Cornwall, which was one of the wettest parts of the country.

Making Mechanization Pay

In a paper on "Making Machinery Pay on the Small Farm," Mr. Frank Henderson, a farmer of Oathill, Enstone, Oxford, said that a useful yardstick for a farmer buying a machine was: Could he increase his output from the farm each year by the amount he would have to spend on that machine? That is to say, if he spent £100 on a machine, could he increase the output from the farm by £100 without any extra expenditure on labour? Machines which were in use every day, such as milking machines, tractors and incubators, could easily come within the yardstick. A machine would always justify itself when used on production work for a great number of hours in the year and for that reason those which were used in connection with livestock production were more profitable than the ones used solely for crop production. Machinery must be used to increase the output per person and not simply to save labour. An important factor in making machinery pay was to have the right tool for the job. On many farms one saw tractors doing jobs which could well be done by fractional h.p. electric motors. With electricity at 1d per kWh a 4 h.p. motor would run at about 3d per hour, but plenty of tractors were to be seen doing the same work at 5s–6s per hour.

Very few general farms could stand a machinery cost of more than 15 per cent of the total sales and by machinery cost he meant depreciation, fuel, oil, repairs and hire of machinery. If it did not exceed this figure then labour costs must be reduced in the same proportion; but in any case labour and machinery costs must not exceed 40 per cent of total sales.

Mr. F. Coleman (Royal Agricultural College, Cirencester) pointed out that full benefit of electrically operated apparatus was not obtained unless automatic controls were employed. Mr. F. E. Rowlands (G.E.C.) questioned a suggestion by Mr. Henderson that small farmers might advantageously buy secondhand machinery.

ELECTRICITY SUPPLY

Route of 275 kV Line

New S.E.B. Standard Commercial Tariffs

DIVERSION of the proposed 275 kV line from Stella to Carlisle, because it would pass over good agricultural land, was called for at a conference of local authorities, landowners, farmers and others held at Hexham last week.

Mr. Rupert M. Speir, M.P. for Hexham, who presided, said the line would be carried on towers 115ft high—25ft higher than any others in the country. So far he had seen no sign of any concession on the part of the B.E.A., and it was time that the Authority dropped its "take it or leave it" attitude and paid more attention to local people and local requirements.

Mr. R. E. Wacher, chief wayleaves officer, said that the B.E.A. had no wish to be uncompromising or unco-operative. It was not its own master, being governed by the planning authorities.

A resolution was passed urging that discussions should take place immediately between the Northumberland County Planning Authority and agricultural and amenity interests to suggest an alternative route which would be satisfactory to all.

Mr. Wacher said he felt that if the Council for the Preservation of Rural England and the Northumberland Planning Authority could get together and agree, there might be a good chance of the Minister of Fuel and Power and the B.E.A. accepting the diversion proposed by the N.F.U.

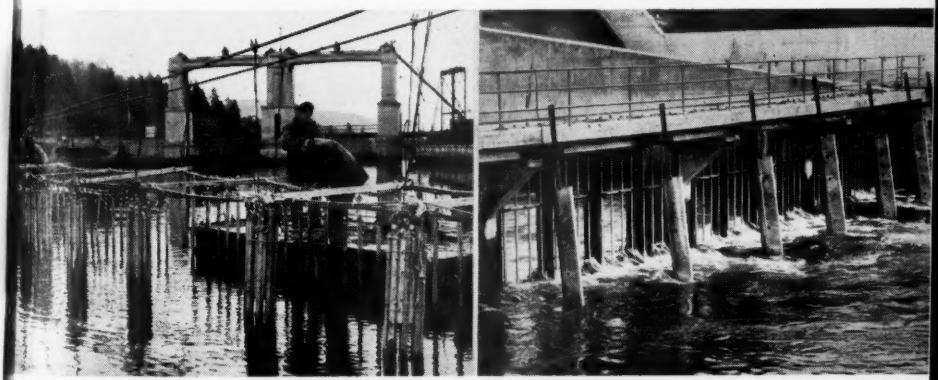
Admission of Press

Normally the district committee meetings of Electricity Consultative Councils are held in private. The Montgomeryshire, Merionethshire and Cardiganshire Committee of the Merseyside and North Wales Council, however, has recommended that its meetings should be open to the Press.

Kestrels on 66 kV Lines

In *Nature* Mr. H. Lloyd, of the Yorkshire Electricity Board, describes how kestrels have been causing faults in 66 kV lines in Yorkshire and North Lincolnshire without fatal results to themselves. Mr. Lloyd says that the incidents always occurred in the early morning or in misty weather when the birds' plumage was probably damp. The flashover is initiated across the damp wings when the bird is banking

Workmen wiring the electrodes of an experimental fish screen at Dunalastair dam, River Tummel, Perthshire (*Electrical Review*, **13th Feb., p. 365**). **On the right is a close-up view of the device at Morar for deterring fish from entering the tail race**



steeply with its back to the insulators, and current does not pass through the bird's body. The speed at which the bird is travelling takes it out of the path of the arc before it can be severely burned, although other birds when subjected to high voltages are normally completely carbonized.

The writer concludes: "Bird lovers will be glad to know that, in later forms of construction, two kestrels will have to execute a very complex movement before they get into trouble."

Edinburgh Power Failure

For two hours on 13th February practically the whole of Edinburgh, together with part of the rural area, was deprived of an electricity supply. Newspaper offices and factories on night shift were immobilized, trams were stopped and the B.B.C. Scottish Home Service programme was interrupted. Mr. J. F. Field, divisional controller of the B.E.A. South East Scotland Division, later issued a statement explaining that at 6.20 p.m. there was a flash-over on some of the high voltage insulators in the main grid substation at Portobello. This caused both of the transformers connecting the power station to the grid to be automatically switched out. The probable cause was the collection on the high voltage insulators of a certain amount of salt spray borne in by the wind. This caused a very heavy shock to the large new turbo-alternator which was immediately shut down.

Standard Commercial Tariffs

Following the introduction of a standard domestic tariff throughout its Area in October, 1951, the Southern Electricity Board has now adopted standard commercial tariffs which will come into effect after 1st April next. The tariffs will take the place of more than 100 existing rates for unrestricted supplies to shops, hotels, offices, places of entertainment, public buildings, etc., and places of worship. The principal features of the tariffs are as follows:—

Block Tariff: Initial block, dependent upon the lighting, heating and power installation, at 5½d/kWh; all additional consumption at 1d/kWh.

Demand Tariff (available where the total load installed exceeds 20 kVA): First 20 kVA of measured m.d. at £8 10s/kVA per annum and all in excess at £6 10s/kVA; running charge 0·6d/kWh, subject to an adjustment dependent on the cost of coal.

In accordance with a decision of the Board last May to increase charges to domestic and commercial consumers in order to meet increased costs, the tariffs have been fixed at a level which will yield an additional revenue of 12½ per cent above that from the many existing tariffs. The introduction of these uniform tariffs will result in 40 per cent of the Board's consumers paying less and 60 per cent paying more. Because of the great variation in charges in different parts of the Area the amounts of the decreases and increases will be marked in some individual cases.

Two-part Tariff Basis

The Irish Electricity Supply Board is considering whether it should change the method of computing the fixed charge of the domestic two-part tariffs which is at present based on the valuation of the premises. Several alternative systems are being investigated, including the number of rooms basis. Consumers have been asked to provide the Board's representatives with certain data including the number of electrical appliances used with a view to arriving at comparisons of the various methods contemplated.

Generation in January

The Ministry of Fuel and Power's monthly statement shows that 6,609 million kWh was generated in January by the British Electricity Authority and the North of Scotland Hydro-Electric Board. The Lochaber Power Co. is no longer included and the comparative figures for January, 1952, have accordingly been adjusted by excluding 34 million kWh of hydro-electric energy generated by the company for public supply. The "installed capacity" figure is also reduced by 83 MW.

New generating plant installed during last month at B.E.A. power stations was confined to three boilers, a 300,000 lb/hr Babcock & Wilcox unit at Bromborough, a similarly rated unit of International Combustion manufacture at Poole and a 230,000 lb/hr I.C. boiler at Nechells.

	Fuel consumed Thousand tons		kWh generated Millions			kWh sent out Millions	Installed capacity (m.c.r.) MW
	Coal	Oil	Steam	Water power	Total*		
British Electricity Authority ..	3,668	10·4	6,434	35	6,482	6,108	17,18
North of Scotland H.E.B. ..	31	1·2	46	76	127	125	56
Total for January, 1953	3,699	11·6	6,480	111	6,609	6,233	17,74
Corresponding total for January, 1952	3,554	8·1	6,111	190	6,318	5,973	16,26
Increase or decrease as a percentage of 1952	+4·1	+43·2	+6·0	−41·6	+4·6	+4·4	+9

* The total includes 12·9 million kWh generated by oil engines and 4·6 million kWh by waste heat plants in January, 1953

Hosiery Manufacture

Electrical Arrangements for a New Margate Industry

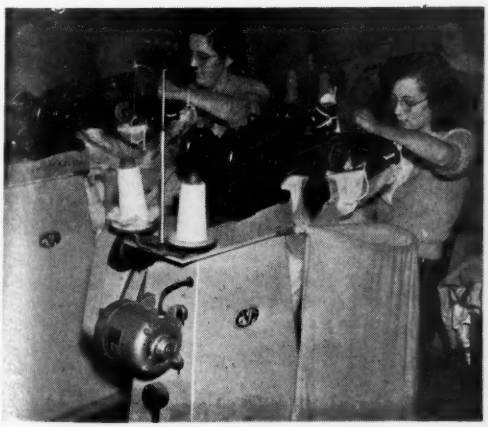
APART from providing all the facilities demanded of a holiday resort Margate has until recently possessed virtually no industries. Following efforts to attract light industries to the area, however, the Klinger Manufacturing Co., Ltd., decided about four years ago to establish a branch of its hosiery manufacturing business there and to erect a large modern factory at Westwood eventually giving employment to a large number of men and women.

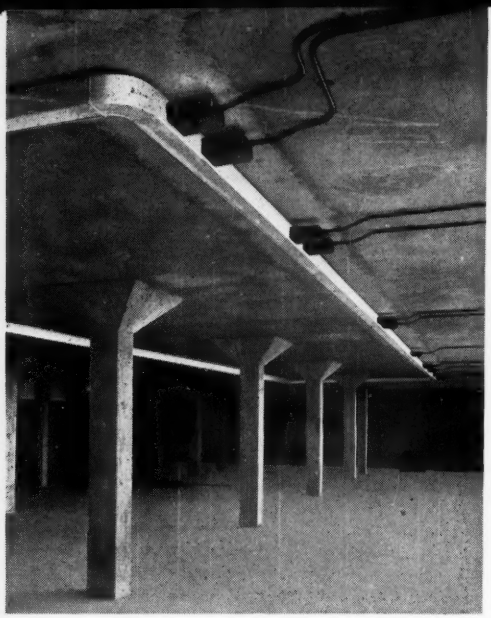
This new factory is now nearing completion and already a portion is in production. New departments are gradually being brought into operation as they are finished, equipment from the London works and from two temporary factories in Margate being transferred group by group at week-ends to avoid loss of output. To-day the stage has been reached when hosiery production at Margate is operating independently of the parent factory, apart from the dyeing.

To prepare for the opening of the new factory the company first started production in Margate in March, 1949, when it established a training department in an old chapel building in Hawley Square. For the time being this is still in use largely for the finishing of socks knitted in one of the other factories, the three-storey construction lending itself well to the purpose. Received on the top floor by means of a 5 cwt King hoist the socks are turned inside out, stacked in dozens, and sent down chutes to the workrooms below. Here C.V.A. linking machines (driven by $\frac{1}{4}$ h.p. or $\frac{1}{6}$ h.p. motors and arranged for speed variation by means of interchangeable pulleys) operated by women link the toes of the socks. There are still a few linking machines remaining here for dealing with hose. After linking, the socks or hose are turned back with the right sides out.

The arrangements for the temporary electrical services are somewhat interesting. "Thermotube" immersion heaters and Carter fan heaters are used for warming the building, and the electricity supplies for the machines are in some rooms carried in

Left: **Linking the toes of stockings.** *Right:* **Trimming the heel and foot splicing with an adaptation of barbers' clippers**





Trunking system in basement of new factory

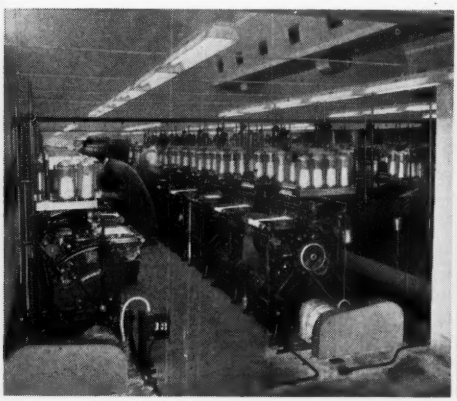
conduit attached to the floor. Other electrical features are Smith "Sectric" clocks, a Rediffusion public address system and an "Autocall" burglar alarm.

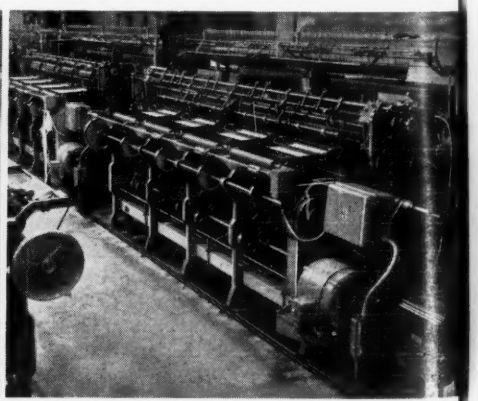
The second temporary factory, another disused chapel in Addington Square, taken over in October, 1950, is devoted to the production of hose, at present entirely in 15 denier nylon. The various operations undertaken comprise sole cutting to remove surplus material on the foot, welting of automatically seamed hose, seaming of automatically welted hose, linking, examination and mending. All the machines used are driven by individual electric motors of $\frac{1}{4}$ h.p. or $\frac{1}{6}$ h.p. Ingenious use is made of barbers' electric clippers fitted with special plastic guards for trimming off the surplus threads before seaming, the threads thus cut off being collected by means of suction nozzles on the clippers. To facilitate the use of these clippers a number of stands are arranged on a rotary table, a team of girls putting on, trimming and removing the stockings.

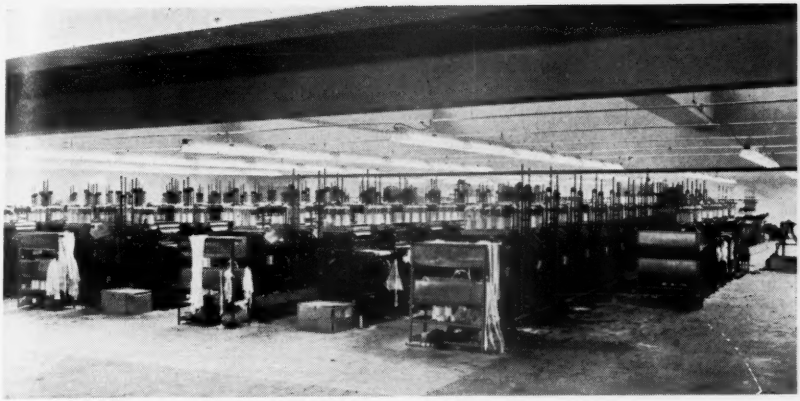
At the new factory at Westwood four knitting bays have so far been put into commission, leaving the rough finishing bay still to be completed. The separate canteen building is also in use already, being employed temporarily for manufacturing purposes to accommodate various types of circular knitting machines. These machines, each of which produces a stocking in sixteen to twenty minutes, are arranged in groups of six, each group being driven by a Brook 3 h.p., 950 r.p.m., 415 V motor.

Though the single head fully fashioned knitting machines, which form the principal production equipment of the main factory, are arranged in groups of ten, also driven by 3 h.p. motors, the newest units being installed are individually driven. Each of these machines, which are installed in rows

Left: **Knitting machines showing motor driving group.** *Right:* **One of the latest four-head twin knitting machines, fitted with individual drive**





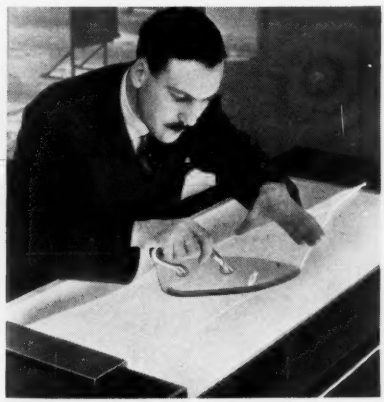


General view of knitting bay in new factory

of twenty, is capable of providing a complete stocking in thirty-two minutes. There are also a few four-head twin knitting machines in use. Inspection of the stockings is carried out on a viewing bench illuminated by fluorescent lamps.

To facilitate installation and rearrangement of equipment a series of holes, concealed when not required by brass screw heads, has been provided in the floors of the knitting rooms so that the necessary wiring can be taken as required from the English Electric trunking system on the ceiling of the basement. This trunking system can be used also to feed downwards to equipment installed in the basement. English Electric switch and fuse gear is used throughout the factory.

Inspection of the stockings is carried out on a viewing bench illuminated by fluorescent lamps



Eventually the factory will be completely air conditioned by means of a Carrier installation. At present facilities are confined to washing and heating the air by means of steam coils served by a semi-automatic oil fired boiler. Impelled by a Keith Blackman 5ft diameter fan driven by a 35 h.p. Lancashire Dynamo & Crypto motor with Allen West control gear, the treated air is admitted to the various production bays by louvres in the ceilings and extracted for recirculation through a series of pillars.

For the high quality lighting required for carrying out the minute operations on the fine gauge threads Philips colour matching fluorescent tubes in a variety of fittings are utilized in all three factories. " Thorlux " fittings are chiefly used.

The main electrical installation at the new works was carried out by the Electrical Equipment Co., Ltd., the local wiring and also the complete electrical installations at the temporary works being undertaken by Walkden (Kent), Ltd. To supply the 450 kW demand anticipated at the new factory the South Eastern Electricity Board has provided a new substation equipped with a Ferranti 500 kVA transformer and English Electric h.v. and l.v. switchgear.

We thank Mr. J. P. Stiles, manager of the factory, for help in preparing this article.

AMERICAN ELECTRICAL TRADE

Increased Exports and Imports in First Half of 1952

ELECTRICAL exports from the United States during the first six months of last year were valued at $308 million, an increase of about 12 per cent on the corresponding period of 1951. The chief items are shown in the accompanying table. Both steam turbine and diesel generating sets showed substantial advances, while refrigeration equipment, including freezers for farm and home, continued to figure prominently, as also did a widening range of cooking and food-servicing apparatus.

Imports of electrical machinery and apparatus into the United States during the first half of last year were valued at $13,866,000, an increase of about 50 per cent on the corresponding period of 1951.

Class of Goods	Jan.-June 1952 $ (000)	Inc. or dec. on Jan.-June, 1951 $ (000)
EXPORTS		
Generators, d.c.	1,792	+ 32
Generators, a.c.	1,974	− 1,364
Steam turbine generator sets	15,830	+ 14,271
Welding sets	5,102	+ 2,289
Electrical generating sets, diesel	15,876	+ 6,473
Self-contained lighting outfits, except diesel	5,740	+ 8,555
Wind-driven generator sets	324	+ 5
Storage batteries	3,951	− 1,623
Flashlight batteries	2,851	− 262
Dry, multiple cell batteries, except flashlight	3,406	+ 438
Other dry and wet cell primary batteries	587	− 394
Capacitors for power factor correction	390	− 91*
Power and distribution transformers, 500 kVA and under	3,046	− †
Ditto, over 500 kVA	5,021	− †
Fluorescent ballasts, regulators and speciality transformers	3,354	+ 485*
Mercury power rectifiers	259	− 377
Rotating convertors, under 150 kW	1,818	†
Ditto, 150 kW and over	1,641	†
Rectifiers, including battery chargers, non-rotating	952	+ 439
Switchboards, panels and parts	7,181	+ 3,298
Oil circuit breakers and switches	1,562	+ 460
Power switches, circuit breakers and parts	8,086	+ 2,618
Fuses and fuse plugs	607	+ 170
Lighting arrestors and choke coils	1,068	+ 295
Watt-hour and other integrating meters	611	− 137
Elec. quantity indicating instruments, non-recording	1,569	+ 575
Elec. quantity recording instruments	424	+ 61
Other elec. quantity measuring and testing instruments, and parts	6,125	+ 3,017
Motors, under 1 h.p.	3,130	+ 278
Motors, 1 h.p. and over	11,032	+ 4,072
Elec. propulsion motors, generators and controls for land transportation vehicles	4,855	+ 2,195*
Industrial motor controls and parts	7,193	+ 703
Elec. mining and industrial locos.	1,167	+ 55
Portable electric tools	3,541	− 226
Elec. household type refrigerators	31,683	− 3,251
Elec. freezers, farm and home type	1,597	†
Parts for refrigerators and freezers	4,961	†
Flashlights	885	− 426
Elec. fans	1,736	+ 534
Small filament lamps, miniature candelabra and intermediate base	2,366	− 22
Large filament lamps and other large base lamps	1,438	− 380
Fluorescent, vapour and non-filament lamps	1,854	− 568
Elec. household washing machines and parts	4,639	− 1,985
Ditto vacuum cleaners and parts	654	− 190
Other elec. household motor-driven appliances and parts	2,893	− 816
Elec. household cooking ranges and parts	1,342	†
Ditto cooking appliances and utensils and parts	614	†
Ditto heating appliances and pts.	713	†
Elec. commercial cooking and food services equipment and parts	969	†
Elec. industrial furnaces and pts.	1,292	+ 27
Elec. industrial heating units, devices and parts	1,349	− 43
X-ray tubes and valves and parts	944	†
Other X-ray apparatus and parts	3,375	†
Electro-therapeutic apparatus and parts	433	− 174
Radio and television apparatus, exclusive of special category type	35,909	− 11,005
Telegraph apparatus and parts	3,469	+ 1,548
Telephone instruments	697	+ 234
Other telephone equipment and parts	7,719	− 1,477
Bells, buzzers, annunciators, alarms and parts	697	− 132
Starting, lighting and ignition equipment and parts, except spark plugs	14,355	+ 5,333
Conduit and fittings, except clay, including outlets and switch-boxes	5,501	+ 368
Elec. lighting fixtures, portable lamps and parts	5,236	+ 672*
Special category types	46,556	+ 16,313
IMPORTS		
Electric lamps, metal filament	225	− 37
Brass bases for elec. lamp bulbs	2	− 4
Vacuum cleaners and parts	31	− 33
Other electrical machinery and apparatus	9,692	+ 2,778
Machines having elec. element or device as an essential feature, n.e.s.	3,916	+ 2,050

* Estimated only, because of variation in classification. † Comparative figures not available.

MANUFACTURING PROGRESS, 1952

Brush Electrical Engineering Co., Ltd.

WITH the disappearance of the sellers' market, and in spite of very keen competition, the Brush Electrical Engineering Co., Ltd., reports favourable progress.

In the turbine division, the year saw the successful completion of the Ljungström modernization programme embarked upon five years earlier. In this period 22 machines, the majority of them owned by the British Electricity Authority, ranging between 15 and 50 MW, have been re-equipped with a blade system of the most modern design, and the operating results have fully justified the programme. Alongside this task there was a steadily increasing flow of normal production which resulted in the completion of one 30 MW turbo-alternator for the British Electricity Authority's Warrington power station, two 6,250 kW sets to be installed at Lourenço Marques, Portuguese East Africa, and a 2,400 kW set for the Kano power station of the Electricity Corporation of Nigeria. In addition, a number of smaller axial-flow turbines were shipped to the sugar industries in Australia and Africa and to cement mills in India.

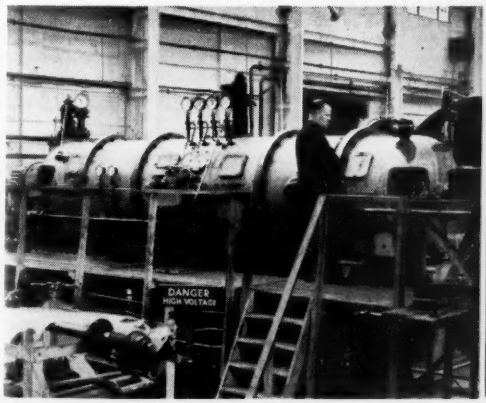
Orders now in hand include three 15 MW Brush-Ljungström sets for Queensland, two 8·25 MW sets for Bangkok and eight sets for the B.E.A., totalling 175 MW. A repeat order has been received for a 12·5 MW Brush-Ljungström set to be installed alongside one due for delivery in the early part of the current year.

The company is building an increasing number of h.v. transformers, and 132 kV units for Australia, and 110 kV, 88 kV and 66 kV units for Tasmania and South Africa form the bulk of this work. Further, a number of 66 kV transformers were built for the home market. Extensions to the factory facilities for drying-out and other processes were in hand.

Continued activity in standardization formed the most important part of the year's work. A number of official impulse tests

Right: **Outdoor 33 kV oil circuit breaker with pneumo-hydraulic stored energy device**

Below: **A 2,400 kW turbo-generator for Kano " B " power station, Nigeria**



were carried out in the h.v. laboratory. Development work in the transformer division was continued in connection with noise measurement, short-circuit forces, thermal problems and the application of grain-oriented steel, etc.

Among the many important items ordered from the company were four 20 MVA, 33/11·5 kV transformers for Pretoria municipality complete with on-load tap changing equipment, which were additional to four similar units delivered during 1952. From the Electricity Supply Commission (Rand undertaking), South Africa, the company received an order for 71 transformers with an aggregate capacity of 206 MVA, the units ranging in size from 1,000 to 15,000 kVA. The largest order from the Hydro-Electric Power Commission of Ontario was for ten 3,000 kVA transformers.

Further production space was allocated to the switchgear division, and in this field an important development was the pneumo-hydraulic circuit breaker closing mechanism which was described in the *Electrical Review* of 21st November, 1952.

Orders were secured from Area Electricity Boards and from an Indian electricity undertaking for a substantial number of 33 kV, 750 MVA outdoor circuit breakers. Large quantities of indoor switchgear of up to 15 kV and 250 MVA were supplied to the National Coal Board, Docks and Inland Waterways Executives, large steelworks and oil producing and refining companies, and to customers in other countries, including the United States and Canada.

Circuit breakers for 350 MVA, 11 and 6·6 kV were developed and tested during the year, and vertical lift switchgear incorporating these is becoming available. The production of fuse switchgear for industrial applications at home and overseas went ahead during the year.

In the rotating machines division considerable reorganization of the testing facilities took place, and two new test areas, one to deal with the largest engine driven alternators and the other to serve d.c. machines, including traction generators and motors, were laid out. Although the induction and d.c. motor shops were heavily committed with large defence orders, production space was increased and further orders were accepted for mining and industrial type flameproof motors and d.c. machines. Included among the latter was an order for fifteen 60 V, 2,000 A motor driven electrolytic plating sets for an entirely new application. A large volume of orders for all types of alternators from 50 to 2,000 kVA was received, and considerable research and development work was undertaken.

Non-Destructive Testing

THE methods, usages and scopes of means of non-destructive testing in industry were reviewed by Mr. J. D. Hislop in a paper read before the North-East Coast Institution of Engineers and Shipbuilders last week.

The main methods of non-destructive testing such as radiography (including gamma-ray examination), magnetic crack detection and its variants, ultrasonics, etc., were all described and their scopes and limitations made clear. The ways in which these several methods could serve the engineer by providing him with information about the soundness and serviceability of the object tested were discussed in the paper together with the parts played by the various people concerned. The paper, which was illustrated, also considered the economics of testing both from the point of view of the cost of testing in this way and of the savings which the use of such methods could bring about.

The awareness of industry of the value of non-destructive testing methods had grown considerably since the war. Manufacturers who during the war were engaged in Government work which was required to be tested by these methods had been glad to retain the facilities then provided for this specific purpose. Care had, however, to be exercised to avoid the adoption of methods which were not well suited to the particular purpose in mind, in order to prevent any weakening of confidence in the method as such rather than in the sometimes misguided and at other times ill-informed advice on which the method might be based. Such experiences, which were fortunately becoming rarer, had definitely set back some methods which, when properly used and applied, could be of extreme value and often even more satisfactory than simple X-ray photography in particular spheres and applications.

METER TESTING

Use of Electrically Driven Stroboscopes

PARTICULARS of methods adopted by the London Electricity Board for testing kilowatt-hour meters with electronically driven stroboscopic equipment were given by Mr. A. J. Baggott in a lecture on 13th February to the Meter Engineers' Group of the Electrical Power Engineers' Association. It was pointed out that while meters could be calibrated by the stroboscope, any consequent errors could be very simply determined by electronically driven counters.

The disc of the standard meter, driven from the secondary of the stroboscope current transformer, was drilled with 200 holes; it had a projector lamp below it and a photo-electric cell above it, so that 200 light pulses per revolution were focused on to the photo-cell electrode and converted into small voltage pulses which were amplified to drive either the stroboscope lamp or the electro-magnetic counters.

The discs of the meters under test were marked with 200 lines and their speeds were adjusted so that they were viewed under a light that was in sympathy with the number of lines. At 5 per cent load an appropriate artificial load transformer tapping gave a standard-meter speed twenty times that of the meters being tested, originating 4,000 pulses per revolution. These pulses were usually counted by a general electro-magnetic counter which gave 1,000 divisions in the main dial for each revolution of the meter.

Disadvantages of the electro-magnetic counter were starting and stopping errors of the mechanical drive and possible troubles in the mechanical resetting arrangements, while the frequency response was limited to a band of 30 to 100 c/s. A cold-cathode tube instrument recently introduced by Ericsson Telephones, called the "Dekatron," made it possible to count electronically. It would withstand normal rough handling, had a frequency response up to 2,000 c/s and entailed a consumption of only a few milliwatts, compared with 2 to 3 watts required for the synchronous type; the counter had no gears and resetting was achieved electronically merely by the operation of a switch.

The higher capital cost incurred had been justified in many ways. Stroboscopic calibration at high loads was the fastest known method, but it had hitherto been difficult to apply to kWh meters because of the wide range of constants in use. The type of stroboscope mentioned above was independent of such considerations and facilitated calibration according to a predetermined curve. Operators were given testing codes worked out statistically for each type of meter, which simplified arithmetic in error determination and retained the stroboscope as a null method and the counters as a simple reckoning device. Checking the equipment to satisfy the requirements of the Ministry of Fuel and Power had been made much more convenient. Detailed applications of the system were illustrated by numerous lantern slides and by assemblies of the apparatus described.

Scottish Schemes Extended

BECAUSE of the demand for electricity in Kintyre the North of Scotland Hydro-Electric Board has decided to extend its Glen Lussa project, and the Secretary of State for Scotland has confirmed this scheme. It is estimated that the annual output of the generating station in Glen Lussa will be increased from $8\frac{1}{2}$ million to $10\frac{3}{4}$ million kWh, and that the capital cost will be £310,000. Water will be diverted by tunnel from the upper tributaries of the River Barr into the reservoir created under the existing Glen Lussa scheme.

The Secretary of State has also confirmed a scheme to extend the existing Cowal hydro-electric project to meet the increased demand. The scheme will, it is estimated, increase the annual output of the Cowal generating station from 14 million to 18·6 million kWh. The estimated cost is £350,000. The headwaters of a number of small streams flowing into Loch Riddon will be diverted through a pressure pipe to the existing generating station at the head of Loch Striven. The pipe will be buried where it crosses the flat land at the head of the loch.

FINANCIAL SECTION

Company Notes and Stock Exchange Activities

Reports and Dividends

Murphy Radio, Ltd.—Application has been made to the Treasury for consent to issue for cash 200,000 £1 preference shares to rank with the existing 5½ per cent preference capital, and 800,000 5s ordinary shares. The preference shares, it is expected, will be the subject of a placing. The ordinary shares will be offered to existing ordinary shareholders on a *pro rata* basis. The new capital is required to provide for expanding business, for redemption of certain subsidiary companies' debentures, and to finance participation in the projected merger of the company's joint television relay business with another group. Resolutions to raise the authorized capital of the company to £1,750,000 will be placed before an extraordinary meeting on 27th February.

J. & E. Hall, Ltd., report that after deducting £237,462 for taxation, providing £80,000 for diminution in value of stock and work in progress, and providing £100,000 for contingencies, there is a net balance of £57,462 for the year ended 30th September last, as compared with £111,847 for the preceding year. The dividend for the year is unchanged at 12½ per cent by a final payment of 10 per cent, and after adding £85,000, tax provisions no longer required, the balance carried forward is £320,146 (against £225,564 brought in).

The Cables Investment Trust, Ltd., which was formed to acquire investments from Cable & Wireless (Holding), Ltd., is paying an interim ordinary dividend of 3 per cent (against 2 per cent). The directors state that the increased interim does not imply that the total distribution for the current year will be at a higher rate.

S. Guiterman & Co., Ltd., report a consolidated net profit, before taxation, for 1952 of £15,035, as compared with £23,968 for 1951. Taxation requires £7,500 and general reserve receives £3,000. The ordinary dividend for the year is unchanged at 7½ per cent, and £8,866 is carried forward (against £8,835 brought in).

R. B. Pullin & Co., Ltd., report a group profit for the year ended 30th September last, before taxation, of £89,265, as compared with £67,165 for 1950-51. Taxation absorbs £54,904. It is proposed to pay an unchanged dividend for the year of 15 per cent, and to place £10,000 to general reserve.

Waygood-Otis, Ltd., reports a profit for 1952 of £345,761, after providing for depreciation and directors' remuneration. This compares with £266,225 for the previous year. The final dividend proposed is 25 per cent, again making 55 per cent for the year, and the balance carried forward is £16,227 (against £11,720 brought in).

The W. R. Sykes Interlocking Signal Co., Ltd., reports that after providing £23,200 for taxation, the net profit for the year ended 27th September last is £12,783 as compared with £8,308 for the preceding year. General reserve receives £8,003, and a dividend of 6 per cent (same) is paid on one-class preference capital. The balance carried forward is £16,387 (against £12,182 brought

The Lightfoot Refrigeration Co., Ltd., has declared an interim dividend of 3 per cent (unchanged).

New Companies

Aron Electricity Meter (Ireland), Ltd.—Registered in Dublin 21st January. Capital £1,000. Manufacturers and contractors for the sale, supply, letting on hire, erection and maintenance of electricity meters, electric lamps, switches, etc. Subscribers: Miss Sheila O'Rourke, 139, Upper Leeson Street, Dublin, and Miss Sheila Marlow, 4, Clonskea Terrace, Clonskea, Dublin. The first directors are not named.

G. P. Cree, Ltd.—Registered 7th February. Capital £1,000. To acquire the business of electrical engineers and contractors carried on by G. P. Cree at 1, St. Stephen's Street, Tonbridge. Directors: G. P. Cree and H. G. Dehn. Solicitors: F. B. Jevons, Riley & Pope, Bordyke, Tonbridge.

J. R. Williams & Co. (Electrical Engineers), Ltd.—Registered 7th February. Capital £10,000. Directors: C. H. Hodgson (director of H. C. Taylor & Co. (Manchester) Ltd.), J. W. Blenkin and G. T. Pollock. Regd. office: 10, Paton Street, Manchester.

Gloster Glass, Ltd.—Registered 4th February. Capital £100. Manufacturers, repairers and merchants of and dealers in glass and glass tubing for use in connection with tubular or strip or other lighting, etc. Directors: P. H. Dixon and Julia B. Dixon. Regd. office: Wellington & Clifford, Stroud, Glos.

Hill Electrics, Ltd.—Registered 3rd February. Capital £500. Designers, manufacturers, importers and exporters of and wholesale and retail dealers in electrical and electronic apparatus and supplies, etc. Directors: H. L. Hill and P. B. W. Crichton. Regd. office: 7, Windmill Parade, Ruislip, Middx.

G. Clancy & Co., Ltd.—Registered in Dublin 7th January. Capital £5,000. To acquire the business of electrical engineers, contractors and radio dealers carried on as "G. Clancy" at 45, O'Connell Street, Limerick. Directors: G. Clancy and Mrs. Josephine Clancy.

E. J. Frank & Co., Ltd.—Registered 4th February. Capital £100. Electrical equipment specialists, etc. The first directors are to be appointed by the subscribers. Regd. office: 37, Norfolk Street, Strand, W.C.2.

H. Hughes & Son (Worksop), Ltd.—Registered 11th February. Capital £2,000. To acquire the business of electrical engineers now carried on by H. Hughes and J. Hughes at 64, Carlton Avenue, Worksop. Directors: H. Hughes and J. Hughes. Regd. office: 64, Carlton Avenue, Worksop, Notts.

Belsize Village Electrical, Ltd.—Registered 11th February. Capital £1,000. Electricians, radio and mechanical engineers, etc. G. L. Lawrence is first and permanent director. Solicitors: Tamplin, Joseph & Flux, 122, Minories, E.C.3.

Winding-Up Petition Dismissed

Accessories Electrical Supplies (Wholesale), Ltd., South Tottenham, London, N.15. —A petition for the winding-up of this company was dismissed, by consent, on 3rd February.

Liquidation

The Madeira Electric Lighting Co. (1909), Ltd.—Winding up voluntarily, under section 278, sub-section (b) of the Companies Act, 1948. Liquidator, Mr. J. Laughland, of Barton Mayhew & Co., Alderman's House, Bishopsgate, London, E.C.2, appointed 4th February.

Bankruptcies

W. J. Layton, 148, Studley Road, Redditch, Worcs, lately residing and carrying on business at 102, Evesham Street, Redditch, electrical engineer.—Receiving order made 5th February on debtor's own petition.

F. L. Napier, 5, School Road, Sale, Ches, electrical contractor.—Trustee, Mr. G. H. Eaves, 47, Mosley Street, Manchester, 2, appointed 5th February.

H. Tansey, residing and lately carrying on business at 33, Hollydale Road, Erdington, Birmingham, 24, electrical contractor.—Receiving order made 9th February on debtor's own petition.

L. G. Sharp, 4, Summersley's Road, Princes Risborough, Bucks, electrician.—Last day for receiving proofs for dividend 2nd March. Trustee, Mr. J. H. Marshall, Grenville House, High Street, Princes Risborough.

C. F. Adams and **F. Harris**, lately carrying on business at 351, Forest Road, Walthamstow, Essex, under the name of Swift Bros., electrical engineers.—Last day for receiving proofs for dividend 28th February. Trustee, Mr. W. F. Cresswell, Bankruptcy Buildings, Carey Street, London, W.C.2, Senior Official Receiver.

G. Towell (trading as Stafford Radio), 183a, Grange Road, Birkenhead, electrician.—Receiving order dated 5th January, 1953, rescinded and petition withdrawn on 26th January on the grounds that less than £50 was owing at the date of the issue of the petition.

TRADE MARKS

APPLICATIONS have been made for the registration of the following trade marks. Objections may be entered up to the dates mentioned.

4th March

TELEVISTA. No. B711,623. Class 9. Television receivers and television projection apparatus and parts included in Class 9.—R. F. E. O'Connor, 786, Mansfield Road, Woodthorpe, Nottingham.

11th March

NATIONAL (design). No. 705,691. Class 7. Electrical machines and parts included in Class 7 for cleaning horological and scientific instruments; and soldering machines and watch glass cutting machines.—S. Lanzetter, 36–40, New Brown Street, Manchester, 4.

NAUTILUS. No. 712,410. Class 7. Electric motors (not for land vehicles).—Yeovil Sheet Metal Co., Ltd., Nautilus Works, Yeovil.

SIERA (design). No. 712,743. Class 8. Electric shaving instruments and apparatus; vaporizers, etc.—N. V. Siera Radio, The Hague, Holland. Address for service, c/o T. D. Threadgold, Century House, Shaftesbury Avenue, London, W.C.2.

RAYTHEON MARINERS PATHFINDER. No. 697,853. Class 9. Radar apparatus for use in marine navigation.—Raytheon Manufacturing Co., Newton, Co. Middlesex, U.S.A. Address for service, c/o F. B. Dehn & Co., Kingsway House, 103, Kingsway, London, W.C.2.

DIALAM. No. 712,731. Class 9. Electrical apparatus included in Class 9.—Permali, Ltd., 125, Bristol Road, Gloucester.

PIFCO. No. 713,230. Class 10. Appliances for massage of the face and body; galvanic belts for medical use; lamps for medical or surgical purposes, and bed warmers. PIFCO. No. 713,231. Class 11. Table lamps, flash lamps and electric torches, electric lamp bulbs, hand lamps, lamps for cycles and motor cycles, lampshades and lampshade holders and hurricane lanterns.—Pifco, Ltd., Pifco House, Watling Street, Manchester, 4.

BY-WAY VALUE. No. 702,233. Class 11. Boilers for washing purposes, heating stoves, refrigerators, electric fires and electric lamps (not being lamp bulbs).—W. T. Norton, H. Norton, E. Norton, J. Norton and E. B. Norton, trading as A. J. Norton & Sons, 28, Key Hill, Birmingham, 18.

STOCKS and SHARES

THE rise in the price of home industrial shares steadily continues. In many cases, the appreciation since even the beginning of the year has reached really substantial proportions, with investment showing a bias in favour of the electrical and other engineering companies and a keen interest in the dividends and results due to be declared over the next month or two in respect of 1952. Reyrolle ordinary have repeated the previous week's performance in rising by half-a-crown. Midland Electric Manufacturing added 2s to an earlier rise of 2s 6d. Among others to improve further upon previous advances are Johnson & Phillips, Westinghouse Brakes, London Electric Wire, British Vacuum Cleaners and Hackbridge Cables.

Other Improvements

Metal Industries provided one of the week's best features in rising 3s 6d to 46s on the maintenance of the interim dividend at the same rate as before, but on capital increased by 25 per cent as a result of a one-in-four share bonus. Other improvements deserving mention include those in Telegraph Constructions, Siemens, Thorn Electrics and Southern Areas. General Electrics were firm, in advance of the interim dividend statement, and Ericssons hardened in anticipation of the final dividend: this company has been among the most conservative dividend payers of recent years.

Decca Developments

Shareholders in the Decca Record Company were due to receive yesterday (Thursday) their provisional allotment letters in connection with the capital issue, and, at about the same time, to hear the final dividend decision and preliminary profits statement for the year ended last March. Both the interim payments for that period had already been raised. In advance of these events, the 1s ordinary shares continued their rise to 22s 3d, which compares with a quotation of 18s only a month ago. The new shares are being offered to existing holders at 5s, in the proportion of one for every twelve shares held. At the time of the announcement, this made the "rights" worth about 1s 4d per share. The new shares will not be entitled to the final dividend about to be distributed.

Shares on Offer

With the persistence of a steady demand for industrial shares, and with investors apparently not to be tempted out of good holdings by the recent general rise in prices, supplies of stock in the industrial market are becoming by no means plentiful. It may again be of service to mention some of the ordinary shares which have been available lately in the electrical markets, and in fair numbers. Among the big issues, offering yields of between 5 and 5½ per cent on the basis of the dividends last paid, are A.E.I. and General Electrics, Henley's and B.I.C. Crompton Parkinson and Walsall Conduits have been available on a prospective yield basis of rather more than 5¾ per cent, while Lancashire Dynamos and Siemens could be bought to yield a little under that figure.

Higher Yields

Shares recently on offer to give the buyer a return of a little more or less than 6 per cent on the money, include Hackbridge & Hewittic, Revo, Ever Ready and Brook Motors. Watford Electrics yield £7 8s 3d per cent, while on the offered prices there is a return of about 7¾ per cent on Marryat & Scott and Aberdare Cables, the latter company having raised the dividend this month to 25 per cent. Phoenix Telephone 5s shares at 6s 9d pay nearly 7½ per cent, while on Southern Areas and on R.B. Pullin 2s shares at 3s 7½d the yield on the last dividends is over 8 per cent.

H. J. Baldwin

Although the official quotation remains unchanged at a middle price of 3s 6d, business was recorded last week in H. J. Baldwin 2s ordinary shares up to 3s 10½d, which was 6d better than prices marked near the beginning of the month. An interim dividend is due to be declared shortly, on account of the year ending next month. News is awaited also in connection with steps taken last year in preparation for a capital issue. An offer of preference shares, with the object of reducing temporary borrowings, was foreshadowed in the annual report issued a few months ago. This disclosed a substantial increase in the year's earnings, but the dividend was lowered from 25 to 20 per cent in the face of the increase in the distributed profits tax. The shares stand on a yield basis of over 11 per cent.

Official Quotations

Reference in the above note to movements in the price of H. J. Baldwin shares calls to mind a matter sometimes perplexing to those not familiar with the Stock Exchange Official List of quotations. This daily publication gives against every security the official quotation for the buying and selling prices (it is 3s to 4s in the case referred to) and, alongside it, a record of the prices at which shares are notified as having actually changed hands during the day or on the latest occasion. These "markings," as they are called, can consequently show quite large market movements without always altering the "official" quotation. It may also be observed here that the latter is taken as the basis for the middle prices shown in the weekly list of electrical stocks accompanying these notes.

ELECTRICAL INVESTMENTS

Past Week's Price Changes

Company	Dividend Previous	Dividend Last	Middle Price 16th Feb. 1953	Week's Rise or Fall	Est. Yield p.c. £	s	d
Gilt-edged and Overseas Stocks							
Brit. Elec. 1968/73	3	3	86	—	3	9	9
Brit. Elec. 1974/77	3	3	83½	+½	3	11	10
Brit. Elec. 1976/79	3½	3½	90½	+½	3	17	4
Brit. Elec. 1974/79	4½	4½	101	—	4	4	2
Calcutta Elec. ..	6†	6†	20/-	—	6	0	0†
East African Power	7	7	23/-	—	6	1	9
Nigerian Elec. ..	10	10	21/9	—		—	
Palestine Elec. "A"	5†	Nil	8/-	—		—	
Perak Hydro-Elec.	Nil	Nil	14/6	—		Nil	
Equipment and Manufacturing							
AberdareCables(5/-)	20	25	16/6	+3d	7	11	6
Aerialite (1/-) ..	83½	88½	9/6	—	9	6	0
Allen, W. H. ..	15	15	43/9	+6d		—	
Aron Elec. Ord. ..	15	15	37/6	—	8	0	0
Assoc. Elec. Ord. ..	20	20	78/9	—	5	1	6
Automatic Tel. & El.	15	15	61/3	+ 1/6	4	18	0
Babcock & Wilcox	18	18	72/-	+1/-	5	0	0
Baldwin, H. J. (2/-)	25	20	3/6	—	11	8	9
Bakelite (10/-) ..	—	—	16/3	—		—	
British Aluminium	10	12	42/-	+9d	5	14	3
B.I. Callender's ..	7½	9	35/3	+ 1/6	5	2	3
British Thermostat (5/-)	30	30	32/6	—	4	12	4
British Vac. Cleaner (5/-)	25	25	15/-	+6d	8	6	8
Brook Motors (10/-)	20	20	32/6	—	6	3	1
Brush Ord. (5/-) ..	10	10	5/-	—	10	0	0
A. F. Bulgin (1/-)..	27½	30	2/7½	—	11	8	6
Burco (5/-) ..	38½	35	19/3	+6d	9	1	9
Chloride El. Storage	15	15	67/6	—	4	9	0
Cole, E. K. (5/-) ..	25	25*	17/6	—	7	2	10
Cossor, A. C. (5/-)	Nil	10	10/6	—	4	15	3
Crabtree (10/-) ..	17½	17½	32/-	+9d	5	9	5
Crompton Parkinson Ord. (5/-) ..	11¼	11¼	9/6	—	5	18	5
De La Rue (5/-) ..	50	35*	8/-	+6d		—	
Decca (1/-) ..	112½	112½	22/3	+9d	5	1	0
Dewhurst (2/-) ..	22½	19*	5/-	—	7	12	0
Dictograph Tel. (2/-)	20	20	5/6	—	7	5	6
E.M.I. (10/-) ..	12	12	13/3	—	9	1	3
Electrical Components (5/-) ..	20	20	10/-xd	—	10	0	0
Elec. Construction	15	15	55/-	—	5	9	1
Enfield Cable Ord.	7½	7½	24/-	—	6	5	0
English Electric ..	15	15	58/9	—	5	2	0
Ericsson Tel. (5/-)	22†	22*†	43/-	+6d	2	11	2†
Ever Ready (5/-)..	35	35	27/6	—	6	7	3
Falk Stadelmann..	15	15	42/-	—	7	2	10
G.E.C. Ord. ..	22½	22½	43/6	+3d	5	3	6*
General Cables (5/-)	30	30	15/-	—	10	0	0
Greenwood & Batley	15	15	38/3	—	7	16	10
Hackbridge Cable (5/-)	20	20	11/9	+6d	8	10	3
Hackbridge Hewittic (5/-)	18	20	16/3	—	6	3	0
Hall Tel. Acc. (10/-)	10	10	9/3	—	10	16	2
Heatrae (2/-) ..	12½	12½	4/-	—	6	5	0
Henleys (10/-) ..	20	20	18/6	—	5	8	0
Hellophane (5/-) ..	15	20*	11/6	—	8	14	0
Hoover (5/-) ..	37½	35*	24/3	—	7	4	4
Intl. Combustion (5/-)	20	25	13/6	—		—	
Johnson & Phillips	15	15	57/-	+ 1/6	5	5	3
Lancashire Dynamo	22½	12½*	43/9	—	5	14	2
Laurence,Scott(5/-)	12½	15	13/3	—	5	13	3
London Elec. Wire	12½	12½	57/6	+ 1/6	4	7	0
J. Lucas	7½	9½	40/-	—	4	11	8
Marryat & S. (2/-)	22½	22½	5/-	—	9	0	0
Mather & Platt ..	12½	12½	45/-	+6d	5	11	1
Metal Industries ..	10	15	45/9	+3/6		—	
Mid. Elec. Mfg. ..	15	15	59/6	+2/-	5	0	9
Murex	12½	15	58/-	+6d	5	3	6
Newman Ind. (2/-)	6	10	2/3	—	8	17	10
Oldham & Son (1/-)	30	35	2/6	—		—	
Parnall (Yate) (5/-)	6	6	3/6	—	8	11	6
Parsons, C. A. ..	15	10*	62/6	—		—	
Plessey (5/-) ..	22½	25	22/6	—	5	11	1
Pye Deferred (5/-)	18	18	17/3	—	5	4	4
Revo (10/-) ..	27½	27½	44/6	+9d	6	3	6
Reyrolle	15	10*	56/3	+ 1/6		—	
Scot. Cable (4/-) ..	30	32	12/3	—		—	
Siemens Ord. ..	10	10	35/6	+6d	5	12	8
Southern Areas ..	Nil	5	12/3	+ 1/6	8	3	3
Strand Elec. (5/-)..	17½	17½	8/9	—	10	0	0
Sturtevant (5/-) ..	16¼††	17¼*†	24/6	—		—	
Switchgear&Cowans (5/-)	22½	22½	16/-	—	7	0	8
Taylor T. (5/-) ..	20	20	19/3	—	5	4	0
T.C.C. (10/-) ..	20	20*	38/-	—		—	
T.C. & M... ..	10	10	28/-	+1/-		—	
TelephoneMfg.(5/-)	10	10	9/3	+3d	5	8	0
Thorn. Elec. (5/-)..	10	12½	9/6	+ 1/6	6	11	6
Tube Investments	25	15*	61/3	—	4	18	0
Vactric (5/-) ..	Nil	Nil	4/6	—		Nil	
Veritys (5/-) ..	Nil	7½	5/-	+3d	7	10	0
Walsall Conduits (4/-)	70	70	46/6	—		—	
Ward & Goldstone (5/-)	45	45*	31/-	—		—	
Watford (2/-) ..	25	25	6/9	—	7	8	3
Westinghouse Brake	14	11	57/6	+ 1/6	4	17	6
West, Allen (5/-) ..	12½	15	11/-	—	6	16	4
Trusts, Transport and Communications							
Anglo-Am. Tel.: A Ord. ..	—	6	78	+½	7	13	9
Ord.	—	3¾	52½	−2½	7	2	9
Anglo-Portuguese	8	8	21/6	+3d	7	8	10
Brit. Elec. Traction: Def. Ord. ..	22½	25	485	+10	5	3	0
Cable & Wireless: Ord.	6	8	126½xd	−1	6	6	6
4% Loan ..	4	4	91½	—	4	4	9
Calcutta Trams ..	6†	6†	22/3	−3d	5	7	9†
Cape Elec. Trams	5	5½	10/-	—	11	9	0
Marconi Marine ..	10	10	31/6	+3d	6	7	0
Oriental Tel. Ord.	16	16	60/-	− 1/6		—	
Telephone Props...	8	8	33/9	—	4	14	10
Tele. Rentals (5/-)	10	10	9/3	+3d	5	8	1

* After capital bonus.
† Dividends are paid free of Income Tax.

NEXT WEEK'S EVENTS

Monday, 23rd February

BIRMINGHAM.—James Watt Institute, Great Charles Street, 6 p.m. I.E.E. South Midland Radio Group. "High-Gain d.c. Amplifiers," by K. Kandiah and D. E. Brown.

BOURNEMOUTH.—Grand Hotel, Firvale Road, 8.15 p.m. A.S.E.E. Bournemouth Branch. "Electrical Progress and Developments," by E. H. Turle.

CARDIFF.—At the South Wales Institute of Engineers, Park Place, 6 p.m. I.E.E. Western Utilization Group. "The Electrical Installation in a Nylon Yarn Factory," by B. C. Robinson.

LEEDS.—24, Aire Street, 6.15 p.m. I.E.S. Leeds Centre. "Lighting in Mines," by W. L. J. Potts.

The University, 7.30 p.m. Incorporated Plant Engineers, West & East Yorks Branch. W. A. Wordley on his recent visit to America as a member of the Fuel Conservation Team.

LEICESTER.—Demonstration Theatre, E.M.E.B., Charles Street, 6.30 p.m. I.E.S. Leicester Centre. "Lighting for Display," by T. S. Jones.

LONDON.—Savoy Place, 5.30 p.m. I.E.E. Radio Section. "Radio Aids for Airport Control," by G. W. Stallibrass.

NEWCASTLE-UPON-TYNE.—Neville Hall, Westgate Road, 6.15 p.m. I.E.E. North-Eastern Centre. "A Logical Approach to the Problems of Electric Space Warming," by D. H. Parry.

Tuesday, 24th February

CARDIFF.—Demonstration Theatre, South Wales Electricity Board, 5.45 p.m. I.E.S. Cardiff Centre. "Modern Airport Lighting," by J. W. Morse.

HULL.—Y.E.B., Ferensway, 7.15 p.m. I.E.E. North Midland Centre. District meeting. "The Equipment of Battery-Electric Vehicles," by W. D. Sheers.

LEEDS.—1, Whitehall Road, 6.30 p.m. I.E.E. North Midland Students' Section. "An Outline of Television Systems," by Dr. R. L. Smith-Rose.

LIVERPOOL.—Electricity Board's Service Centre, Whitechapel, 6 p.m. I.E.S. Liverpool Centre. "The Development of the Tungsten Lamp," by B. P. Dudding. (Joint meeting with the E.C.A. Liverpool Branch.)

LONDON.—Savoy Place, 7 p.m. I.E.E. London Students' Section. "The Formation of the Electric Spark," by Dr. E. H. Cohen.

Great George Street, S.W.1, 5.30 p.m. Institution of Civil Engineers. "The Application of Precast Concrete to the Construction of Acton Lane 'B' Power Station," by J. A. Derrington and A. G. S. Lance.

Connaught Rooms, W.C.2. Institute of Transport. Informal luncheon.

MANCHESTER.—Engineers' Club, Albert Square, 6.15 p.m. I.E.E. North-Western Measurements Group. Discussion on "Recording Instruments," opened by W. Bamford.

WOLVERHAMPTON.—Technical College, Wulfruna Street, 7.15 p.m. British Institution of Radio Engineers, West Midland Section. "The Development of the Radio and Electronics Industry in India," by G. D. Clifford.

Star and Garter Royal Hotel, 7 p.m. Institution of Works Managers, Wolverhampton Branch. "Report of the U.K. Specialist Team on Plant Maintenance," by H. G. Hilton. (Joint meeting with Incorporated Plant Engineers.)

YORK.—The Creamery Restaurant, Pavement, 7.30 p.m. A.S.E.E. York Branch. "Rupturing Capacity of Switchgear," by J. Sykes.

Wednesday, 25th February

COVENTRY.—7 p.m. Junior Institution of Engineers, Midland Section. District meeting. "Automatic Feed Press-working," by C. H. Crawford.

LONDON.—Savoy Place, 5.30 p.m. I.E.E. Supply Section. "The Testing and Specification of Bushings in Relation to Service Conditions," by H. Barker and H. Davies.

Lighting Service Bureau, 2, Savoy Hill, W.C.2, 6 p.m. Illuminating Engineering Society. Informal meeting. Discussion on the Lighting of Pedestrian Crossings.

Royal Society of Arts, John Adam Street, Adelphi, 2.30 p.m. Royal Society of Arts. "Improving Coal Production," by E. H. Browne.

MIDDLESBROUGH.—Cleveland Scientific and Technical Institute, Corporation Road, 6.30 p.m. I.E.E. Tees-Side Sub-Centre, Students' Section. Film show.

NEWCASTLE-UPON-TYNE.—King's College, 6.30 p.m. I.E.E. North-Eastern Students' Section. "High-voltage D.C. Transmission," by C. G. Hopper and B. D. Ripley.

STAFFORD.—English Electric Co.'s Education Dept., Lecture Theatre, 7 p.m. I.E.E. North Staffs. Sub-Centre, Students' Section. "Some Aspects of Automatic Control of Cold Strip Rolling Mills," by R. W. Sutton.

SWANSEA.—Y.M.C.A., 6 p.m. I.E.S. Swansea Group. "Modern Airport Lighting," by J. W. Morse.

WEYMOUTH.—South Dorset Technical College, 6.30 p.m. I.E.E. Southern Centre. "The Technique of Manufacture of Reliable Valves," by Dr. E. A. Roberts.

Thursday, 26th February

BRADFORD.—45–53, Sunbridge Road, 7.30 p.m. I.E.S. Bradford Group. "Interior Decoration and its Influence on Lighting."

BRISTOL.—Electricity House, Colston Avenue, 7.15 p.m. E.P.E.A. South Western Technical Group. "Operation of the British Grid System," by L. B. Law.

Electricity House, 7 p.m. I.E.E. Bristol Students' Section. "Electric Differentials," P. L. Cloot.

At Carwardines, Ltd., Baldwin Street, 7.15 for 7.45 p.m. Purchasing Officers' Association, West of England Branch. "Purchasing and Production," by H. H. C. Wood.

LEEDS.—Great Northern Hotel, 7 p.m. Purchasing Officers' Association, Yorkshire Branch. "Purchasing in Industry," by F. J. White.

LONDON.—Grosvenor House, Park Lane, W.1. 7 for 7.30 p.m. Institution of Electrical Engineers. Annual dinner.

LUTON.—George Hotel, 8 p.m. A.S.E.E. Luton Branch. "Some Applications of Heat Exchange," by H. E. Holt.

Friday, 27th February

LLANDUDNO JUNCTION.—Electricity House, 6.30 p.m. I.E.E. Mersey & North Wales Centre. "Domestic Electrical Installations: Some Safety Aspects," by H. W. Swann.

LONDON.—Townsend House, Greycoat Place, S.W.1, 7 p.m. Junior Institution of Engineers. "Electronics in Materials Handling," by L. Landon Goodman.

MIDDLESBROUGH.—Town Hall. E.I.B.A. Tees-Side Branch. Annual ball.

PORTSMOUTH.—B.E.A. Southern Division H.Q., 7 p.m. E.P.E.A. Southern Technical Group "The Behaviour and Failure of Metals under Service Conditions in the Supply Industry," by H. E. Davies.

Saturday, 28th February

LONDON.—I.E.E. London Students' Section, 9.30 a.m. Visit to National Film Theatre, S.E.1.

Universities and Industry Conference

THE Federation of British Industries has published a report of the Universities and Industry Conference which was held in October last at Ashorne Hill, Warwickshire. It is obtainable from the Federation, 21, Tothill Street, London, S.W.1, price 5s.

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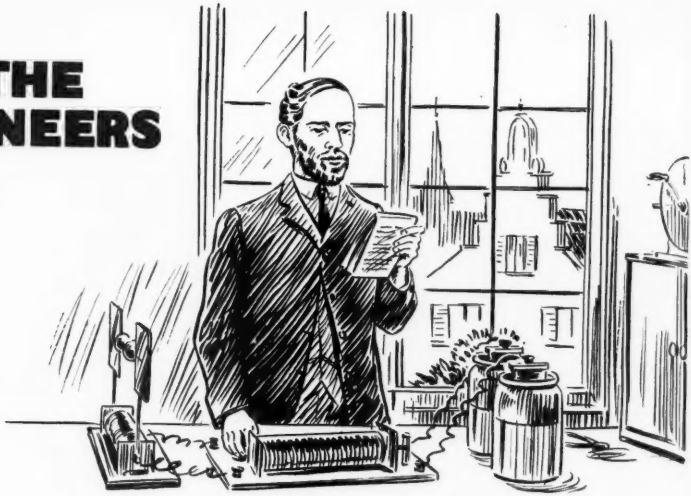

OF METAL RECTIFICATION

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Power Supply in Tasmania

Construction Programme Slowed Down

ALTHOUGH electricity rationing has had to be resorted to in Tasmania, for financial reasons the Hydro-Electric Commission has found it necessary to slow down its large construction programme. Actual capital expenditure in 1951–52 rose sharply to £8,605,335 from £5,705,254 in the previous year and £3,497,896 in 1949–50. As loans available from the Treasury during the year were insufficient by nearly £2 million to provide this sum, it was necessary to realize on securities forming part of the provisions for depreciation, superannuation, etc., and to incur a bank overdraft. Referring to this matter in its report for the year ended 30th June last, the Commission says it was not pleasant to have to cancel orders for goods after having impressed on suppliers the need for early deliveries. So far as possible only orders for standard equipment have been stopped. For special types payment has been deferred by agreement with the suppliers.

The Commission last year devoted its resources to completing the Tungatinah, Trevallyn and Lake Augusta schemes. Work on the Wayatinah and Lake Echo development approved by Parliament in 1951 and for which a contract was subsequently negotiated with the English Electric Co., Ltd., was confined to access roads and camp construction. Operation of the Tungatinah station is expected to start about the middle of this year and the new capacity should enable the Commission to take up outstanding bulk loads, though not to remove the rationing.

During last year 5,548 new consumers were connected in retail supply areas compared with 5,792 in the preceding year. It is estimated that between 92 and 95 per cent of the homes in Tasmania are already supplied with electricity, including over 75 per cent of the farmhouses, so that the rate of connection of new consumers will in future be largely governed by the building of new homes.

Electricity generated in 1951–52 aggregated 1,086·0 million kWh against 1,020·6 million in 1950–51, the installed generator capacity being 211,700 kW (184,500 kW) and peak load 204,297 kW (192,443 kW).

Sales by the Retail Supply Branch totalled 383·3 million kWh, an increase of 11 per cent. This was made possible by the completion of the Butler's Gorge power station, but the potential increase in sales without rationing would probably have been about 20 per cent.

Under the Hydro-Electric Commission Act of 1944 the State makes a capital contribution of 75 per cent towards the cost of uneconomic extensions. When those approved up to June last have been completed the capital contributions paid to date will amount to £655,413—equivalent to £80·4 per consumer—and the grants for operation and maintenance will total £36,172 per annum. Notwithstanding the subsidy, the cost of rural supplies continues to result in a trading loss.

The Commission's accounts show a revenue of £1,873,915 (£1,646,085), working expenses of £1,028,252 (£771,376) and interest, etc., charges amounting to £934,168 (£864,430), leaving a net loss of £88,505 compared with a profit of £10,279 in 1950–51.

BOOKS RECOMMENDED BY

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NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (2s 8d each including postage) will be obtainable after 1st April, from the Patent Office, 25, Southampton Buildings, London, W.C.2.

1947

4834. Sargrove Electronics, Ltd., and Sargrove, J. A.—Metallizing processes and apparatus. 30th January, 1948. (689561.) Apparatus for and a method of metallizing articles. 19th February, 1948. (689563.)

1949

8212. Ingham, H. W. Denton (Lumalampan Aktiebolag).—Luminophores. 25th March, 1949. Convention date not granted. (689683.)

8941. Missenard, F. A.—Method of heating room spaces by means of elevated heating elements. 1st April, 1949. Addition to 672643. (689567.)

11722. Telephone Manufacturing Co., Ltd.—Automatic telephone exchange systems. 1st May, 1950. (689735.) 11724. Electric relay counting chains and selectors. 28th April, 1950. (689736.)

16790. Westinghouse Brake & Signal Co., Ltd., and Thorp, R. B.—Mimic diagram panels for railway and other indication systems. 2nd June, 1950. (689738.)

30467. Baglow, D. V.—Adjustable supports for electric lamps and the like. 28th February, 1951. Cognate application 30468. 28th November, 1949. (689625.)

1950

4940. Fielden (Electronics), Ltd.—Indicating, recording and control apparatus. 6th February, 1951. Cognate application 21583. 1st September, 1950. (689747.)

6823/4. British Heat Resisting Glass Co., Ltd., and Hann, D. G.—Electrodes for electrically heated glass melting furnaces. 19th March, 1951. (689583/4.)

14338. British Thomson-Houston Co., Ltd.—Waste disposal apparatus. 8th June, 1950. (689701.)

14504. Moffats, Ltd.—Electrical heating unit assemblies for electric ranges. 8th June, 1951. (689495.)

16024. Compagnie Générale de Télégraphie sans Fil.—Travelling-wave tube with an output cavity resonator and with a drift space. 27th June, 1950. (689588.)

17249. Soc. Anon. des Machines Electrostatiques.—Voltage measuring apparatus. 10th July, 1950. (689645.)

22529. British Thomson-Houston Co., Ltd.—Hydraulic press operators. 13th September, 1950. (689653.)

27116. Schneider, K. A.—Apparatus for laying subterraneous cables. 6th November, 1950. (689754.)

27309, 27680 & 27942. British Thomson-Houston Co., Ltd.—Thixotropic compositions. 8th, 13th and 15th November, 1950. (689711/3.)

29142. Heidenwolf, H., and Naimer, H.—Thermo-magnetic overload circuit breaker. 28th November, 1950. (689513.)

29743. Soc. Anon pour les Applications de l'Electricité et des Gas Rares-Etablissements Claude-Paz & Silva.—Electrode arrangement for electric discharge apparatus. 5th December, 1950. (689515.)

31649. Bede, J. A.—Electric paint heater. 29th December, 1950. (689601.)

1951

96. Metropolitan-Vickers Electrical Co., Ltd.—Electrical control systems of the correspondence or balance kind. 4th December, 1951. (689517.)

1061. Babcock & Wilcox, Ltd.—Beater mills and the arrangement of such mills in relation to pulverized fuel fired furnaces. 15th January, 1951. (689719.)

1523. Steatite Research Corporation.—Heavy-metal oxide resistors and process of making same. 19th January, 1951. (689520.)

3108. British Thomson-Houston Co., Ltd.—Continuous reading dead-weight pressure gauges. 8th February, 1951. (689605.)

3730. Compagnie Générale d'Electricité.—Moulding press for joining together the insulation of electric cables in position. 15th February, 1951. (689757.)

4739. Soc. Forni Lubratti.—Electrodes for electric furnaces. 27th February, 1951. (689523.)

5458. Siemens & Halske Akt.-Ges.—Corpuscular ray apparatus operating with magnetic lenses. 6th March, 1951. (689527.)

13545. Multiplex Development Corporation.—Multiplex communications system. 7th June, 1951. (689534.)

15063. Sangamo-Weston, Ltd.—Electrical phase sensitive apparatus. 25th June, 1951. (689538.)

17556. Siemens-Reiniger-Werke Akt.-Ges.—Betatrons. 24th July, 1951. (689542.)

21154. Westinghouse Electric International Co.—Vapour-electric discharge devices. 7th September, 1951. (689549.)

22557. General Motors Corporation.—Manufacture of storage battery grids from sheet lead or lead alloy. 27th September, 1951. (689676.)

22811. Compagnie Industrielle des Téléphones.—Level regulating arrangements in coaxial cable transmission systems. 1st October, 1951. (689554.)

24589. Winchester Electronics, Inc.—Electrical plug and socket connector. 22nd Octoberi 1951. (689764.)

25574. Philco Corporation.—Modulator for pulse signalling systems. 1st November, 1951. (689769.)

26058. Standard Telephones & Cables, Ltd.—Manufacture of capacitors. 7th November, 1951. (689556.)

1952

2279. British Thomson-Houston Co., Ltd.—Terminal bushings for electric transformers and the like. 28th January, 1952. (689560.)

2610. Leitz Ges., E.—Electric ignition devices incorporated in photographic cameras for photographic flash lamps. 31st January, 1952. Addition to 686491. (689618.)

Increased Sales in Penang

THOUGH insufficient capacity at Prai power station made it necessary to continue restrictions on the hire of electrical appliances, the George Town, Penang, municipal undertaking sold 14 per cent more electricity in 1951 than in the previous year. The total of 27 million kWh was, in fact, the highest in the undertaking's history. Mr. M. B. Parsons, the acting municipal electrical engineer and transport manager, in his report, says that the trading result was also very satisfactory. The average price received per kWh sold (private supply) was less than in 1950 (13·324 cents against 14·819 cents) while overall costs rose slightly (12·94 cents in 1951 against 12·664 in 1950) but there was a net surplus of $156,47 , the whole of which was transferred as rate aid.

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

CONTRACTS OPEN

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses.

Birtley (Durham).—24th February. Parish Council. Supply and erection of seven sodium vapour and seven mercury vapour lighting units. S. Hunt, clerk to the Council.

Great Yarmouth.—3rd March. Corporation. Electric cables for one year. (See this issue.)

India.—3rd April. India Store Department. Spares for wireless set. (See this issue.)

BANGALORE.—26th February. Stores Purchase Committee, Government of Mysore. Supply of 66 kV/33 kV metering equipment. (C.R.E. 5198/53. Ten/5719.)*

DELHI.—3rd March. Director General, Supplies and Disposals. Electric lamps of various types. (C.R.E. 5113/53. Ten/5741.)*

Iraq.—BAGHDAD.—28th February. Directorate of Municipalities. Supply of two 50 kW diesel electric generating sets. (C.R.E. 5105/53. Ten/5735.)*

Loughborough.—9th March. Corporation. Street lighting equipment. (See this issue.)

New Zealand.—WELLINGTON.—25th March. Director General (Stores Division) G.P.O. Supply of 500 condensers. (C.R.E. 5233/53. Ten/5754.)*

Northern Ireland.—CARRICKFERGUS, CO. ANTRIM.—2nd March. Northern Ireland Housing Trust. Electrical installations in nine shops, two offices and 70 flats at Sunnilands. Particulars from the Trust at 12, Hope Street, Belfast.

Southern Rhodesia.—SALISBURY.—25th March. Electricity Supply Commission. Supply of 159 distribution type transformers (up to and including 500 kVA) and spares. (C.R.E. 4269/53. Ten/5717.)*

Uruguay.—MONTEVIDEO.—19th March. Administracion de Ferrocarriles de Estado (State Railways Administration). Supply of incandescent electric lamps. (C.R.E. 4410/53. Ten/5708.)* 25th March. Supply of fluorescent electric lamps. (C.R.E. 4453/53. Ten/5708.)*

West Riding.—3rd March. County Council. Electrical installation in proposed new central transport repair depot for County Fire Service. (See this issue.)

ORDERS PLACED

Berwick.—Town Council. Lighting of the Royal Tweed Bridge (£1,341).—G.E.C.

Gateshead.—Town Council. Supply of flashing equipment for 56 beacons (£8 12s 8d each).—Revo Electric Co., Ltd.

*Specifications may be inspected at the Commercial Relations and Exports Department, Board of Trade, Horse Guards Avenue, Whitehall, S.W.1 (Trafalgar 8855).

London.—POPLAR.—Borough Council. Electrical installations and fittings at blocks of flats in the Priory Street area (£1,455).—Holliday, Hall & Stinson, Ltd.

Luton.—Housing and Estate Committee. Recommended. Electrical installations in first six blocks of flats on the Farley Hill estate (£1,870).—Scientific Electric Service Co., Ltd.

WORK IN PROSPECT

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Accrington.—Works, offices, warehouse and stores, Pitt Street; Uni-Relays, Ltd., 57, Abbey Street.

Alton.—Houses (50), Four Marks site; R. J. Holden, clerk to R.D.C., Barton End, Alton, Hants.

Altrincham.—Houses (125), Lorraine Road area, for Sparke & Stephens, Ltd.; J. Cocker, architect, 5, Market Street.

Beccles.—Houses (28), Queen Elizabeth Road; Wm. Clowes & Son, Caxton Works.

Biddulph.—Dwellings (34), Park Lane estate, for U.D.C.; Roberts & Butler, Ltd., Rupert Street.

Billingham-on-Tees.—Houses (24), rear of Victoria Terrace and Queen Terrace; U.D.C. surveyor.

Birmingham.—Alterations and additions, 64, Augustus Road, Edgbaston, to form new research laboratories for University; H. W. Hobbiss, architect, 36, Waterloo Street, Birmingham.

Extensions to King's Norton Grammar School; F. Deeley, Ltd., 210, High Street, Harborne, Birmingham.

Blyth.—Houses (400) to be erected during 1953 by the T.C.; D. W. Foster, borough engineer.

Brighton.—Police houses (18) and a police office at Hollingdean estate (£32,200); Knight Bros. (Brighton), Ltd., 19, Bristol Gardens.

Carlisle.—Territorial centre at Albert Street; James Millar & Sons, 15, London Road.

Chatteris (Cambs).—Ten bungalows for old people near Westbourne Road; U.D.C. architect.

Chester.—Erection of new market; borough surveyor.

Chichester.—Thoracic unit at St. Richard's Hospital; Couzens & Brown, electrical consultants, 9, Old Queen Street, S.W.1.

Colindale.—Factory extension; Witton-James, Ltd., Edgware Road.

Colne Valley.—Houses (30), Sycamore Avenue, Golcar, near Huddersfield, for U.D.C.;

Noel Heppenstall, architect, 135, Armitage Road, Milnsbridge, Huddersfield.

Consett (Co. Durham). — New township (1,700 houses) proposed by U.D.C.; J. J. Eltringham, Derwent Street, Blackhill, Consett.

Cradley Heath.—Garage, workshops and stores, Silverthorne Road, for Upper Stour Valley Main Sewerage Board; G. P. Deeley, engineer, 13, Church Street, Stourbridge.

Crook (Co. Durham).—Development of the Wheatbottom site for U.D.C. (500-600 houses); Page, Son & Hill, architects, 75, King Street, South Shields.

Cumberland.—Factory extensions at Frizington for British Fez Co., Ltd., and new factory at Cleator Moor for Remploy, Ltd.; West Cumberland Development Co., Roper Street, Whitehaven.

Denholme.—Houses (30), Minorca site; F. Atkinson, architect, Old Bank Chambers, Bingley.

East Ham.—Ambulance station, Wellington Road; borough surveyor, Town Hall, E.6.

Enfield.—Laboratories, with canteen; Brimsdown Chemical Works, Ltd., Mill Marsh Lane.

Essex.—Four primary schools in the Harlow area, and secondary school at Ruckholt Road, Leyton (£90,000); H. Conolly, county architect, County Hall, Chelmsford.

Exeter. — Dwellings (77), Whipton Barton estate and Countess Wear estate; city architect.

Factory, Marsh Barton estate; Soper & Ayres, Ltd., builders, Magdalen Street.

Glossop.—Houses (118), Pyegrove site; J. E. Beardshaw & Partner, architects, 186, Oxford Road, Manchester, 13.

Gravesend.—Houses (50), Westcourt estate; borough surveyor, 6, Woodville Terrace.

Grimsby. — Houses (100) at Immingham (erection to start this spring); Rural District Council architect, Grimsby.

Hale.—Houses (67), Delaheys Road estate; H. G. Pownall, U.D.C. surveyor, Ashley Road, Hale, Cheshire.

Hayes (Middx).—R.C. school; Sterret & Blouet, architects, 3, Ashley Place, S.W.1.

Herne Bay.—Houses (71), Greenhill estate; A. S. Wilson & Partners, architects to U.D.C., 8, Storey's Gate, Westminster, S.W.1.

Huddersfield. — Houses (48), Dryclough estate, Crosland Moor; borough planning officer, High Street Buildings.

Hull.—College of further education, Queen's Gardens; Frederick Gibberd, architect, 8, Percy Street, London, W.1.

Jarrow-on-Tyne. — Twenty shops in the Perth Avenue area; borough engineer, Town Hall.

London.—BATTERSEA.—Conversions at Shakespeare Theatre, Lavender Hill, to form up-to-date cinema; Provincial Cinematograph Theatres, Ltd.

CAMBERWELL.—Flats (234), Denmark Hill site; F. S. Palling, architect, 118, Merrion Avenue, Stanmore, Middlesex.

HAMPSTEAD.—Flats (79) and maisonnettes (250), Finchley Road; Louis de Soissons & Partners, architects, 3, Park Square Mews, N.W.1.

SOUTHWARK.—Houses (481), on nine sites, during 1953; R. A. Miller, borough surveyor, Town Hall, Walworth Road, S.E.17.

Luton.—Factory, Wingate Road; Hardall, Ltd., 83, Cardigan Street.

Mynyddislwyn (Mon).—Houses (74), Llwynon estate, Oakdale; S. T. Monte, U.D.C. surveyor, Pontllanfraith, Blackwood, Mon.

Northumberland.—Fire station and firemen's houses at Alnwick for C.C. (£25,000); county architect, County Hall, Newcastle-on-Tyne.

Penrith.—Houses (14), Little Salkeld; R.D.C. surveyor.

Peterborough. — Provisional layout plan approved for some 500 houses, shops and lock-up garages on Walton estate; city architect.

Pontyclun.—Block to accommodate 40 beds, and other work, at the Mental Institution, Hensol Castle; secretary, Welsh Regional Hospital Board, Cathays Park, Cardiff.

Pontypool.—Houses (53), Trevethin; surveyor, Urban Council Offices.

Richmond (Yorks).—Houses (150) in the Catterick Camp area; R.D.C. surveyor.

Rochdale.—Secondary modern school, Spotland (1953-54 programme); borough engineer.

Seaton Valley (Northumberland).—Bus station, Seaton Delaval; T. W. Burgess, U.D.C. surveyor, Council Offices, Seaton Delaval.

Sheffield.—Pithead baths at Ramcroft Colliery; H. Rouse & Sons, Ltd., 30, High Street, Mansfield Woodhouse.

College of technology and commerce; J. Stinton Jones & Partners, electrical consultants, 21, Gloucester Place, W.1.

South Shields.—Proposed secondary school at Whiteleas; J. S. Glover, quantity surveyor, 13, Winchester Street, South Shields.

Stalybridge.—Three-storey block of flats at "Brooklands," Stamford Street; Howard & Benson, architects, 88, Mosley Street, Manchester.

Stockton-on-Tees. — Houses (540), Roseworth (£746,000); borough architect, 28, The Square.

Sunderland.—Development of new housing estate by private enterprise near Dene Lane and Shields Road (700 houses); Lane Fox & Co., Ltd., builders, High Barnes Works, Sunderland.

Todmorden.—Twelve flats at The Shade site; Herbert Hardy, Ltd., Victoria Works, Todmorden.

Upper Edmonton.—Factory and offices, Eley's estate; Leda Chemicals, Ltd., Wharf Road, Ponders End, Enfield.

Wallasey. — Two-storey hostel for elderly people at Pasture Road corner, Moreton (£36,000); borough architect, 142/148, Brighton Street.

Wallsend.—Additions to the Civic Hall; G. N. Teasdale, borough engineer.

Houses, Churchill Street (160) and Coast Road (56); borough engineer.

Warwick.—Three-storey block of shops and flats in Shakespeare Avenue; R. Wormell, borough surveyor, 20, The Butts.

Wood Green.—Office building; Kemlows Diecast Products, Westbury Avenue, N.22.

Yeovil.—Flats (34), Larkhill estate; Petter, Warren & Roydon Cooper, architects, The Old Oxford Inn, West Hendford.